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December, 1941

DEC 8 1941

Heating · Piping and Air Conditioning

gn · Installation
tion·Maintenance

mercial, Industrial
Large Buildings

MONG THOSE PRESENT

How to Figure
Noise Levels—Page 737
(Photo at right shows noise level reading of a fan being taken)

How to Install
Head Meters—Page 744

New Heat Loss
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Picture—Page 747

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. . . and many others

Page 763
Journal Section
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of Heating and
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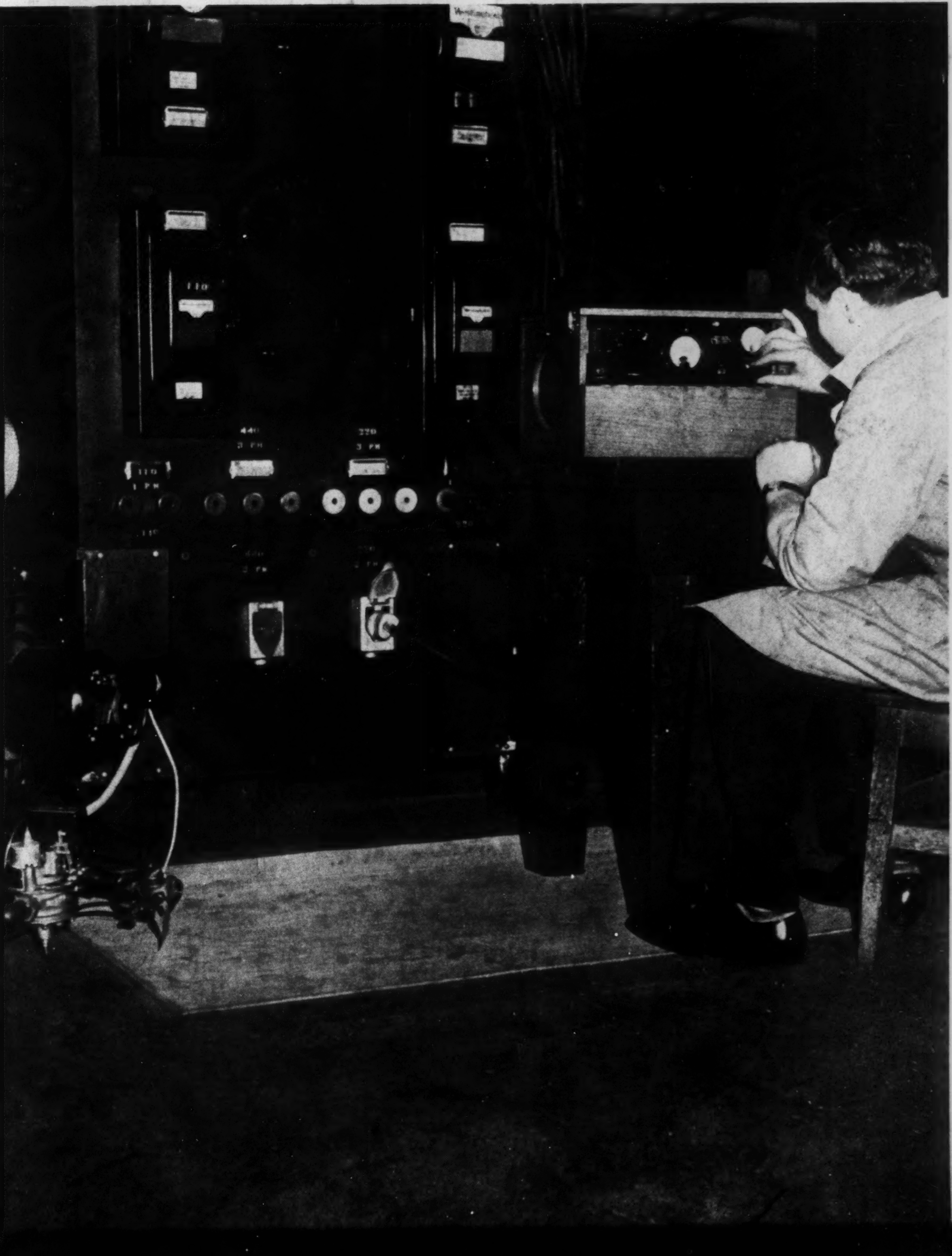

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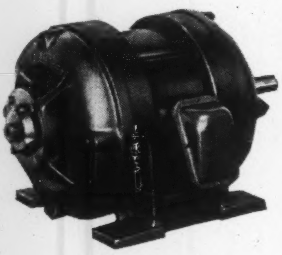

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Especially important for heating, ventilating and air-conditioning work is the extra protection of Lo-Maintenance's distortionless stator . . . twistless . . . fully insulated with special resistant varnish.

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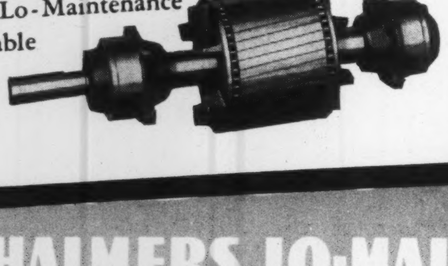
Here's a feature that adds years to the life of your Lo-Maintenance Motor . . . prevents costly repair bills. Allis-Chalmers Lo-Maintenance Motors are available in all standard types and sizes.



ALLIS-CHALMERS LO-MAINTENANCE MOTORS

A COMPLETE LINE FOR EVERY PURPOSE . . . ONE-HALF HORSEPOWER AND UP

The Editor's Pages

ARE YOUR "CLO" AND "MET" RATINGS AT PAR?

Are your "clo" and "met" ratings up to par for winter weather?

These strange terms comprise a new technical yardstick which has been created by three American scientists. They have been developed to tell how much clothing a person will need to adjust to frigid Arctic blasts or tropical heat waves.

The yardstick is expected to have practical implications in showing engineers, physiologists and doctors how rooms should be heated and how people should dress for a variety of weather conditions. It is a systematic standard of describing the necessary heat insulation for the body which protects it from the outside world.

Results of this cooperative research are announced by Dr. A. Pharo Gagge, Yale University biophysicist; Dr. Allen C. Burton, University of Toronto biophysicist; and Dr. H. C. Bazett, professor of physiology at the University of Pennsylvania, in a recent issue of Science magazine.

Two units form the most important portion of the yardstick and are known as the "met" and the "clo." The "met" represents energy value and varies in absolute amount with the size of the individual. For example, for a man of average size, the "met" is approximately equal to the heat generated by a 100 watt lamp. One "clo", on the other hand, is the value of the insulation of a person's everyday clothing. The additional insulation which would be added by topcoats and other clothing can be expressed in "clo" units.

"Speaking in units associated with one's normal experience," say the scientists, "the engineers, the physicians and the physiologists should be able to use their individual training more effectively in a common effort to solve current problems of heating and ventilation, as well as those of the physiological adjustments associated with the maintenance of heat balance."

The "met" and "clo" units take into account the three factors necessary to maintain the best possible human skin temperature, as follows: (1) The rate of heat production of the body, which is, in turn, dependent upon the degree of muscular activity; (2) the insulating value of the clothing; and (3) the environmental temperature.

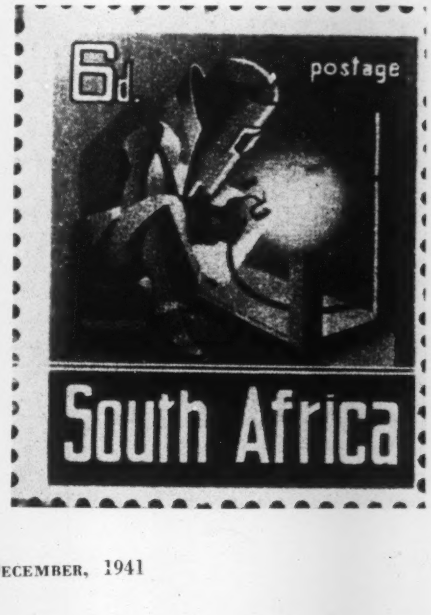
The "met", or energy unit, is defined as 50 kilogram calories per square meter of skin surface per hour (or 18.5 Btu per hr per sq ft), or the heat generated by a man in a comfortable sitting position.

The "clo", or insulation unit, is the amount of clothing necessary to keep a man comfortable, who is in a resting or sitting condition in a normally ventilated room—temperature of 70 F with humidity about 50 per cent.

In describing the ideal clothing which human beings should wear for comfort, the scientists state that "the net efficiency of the human body in performing external work does not exceed 20 per cent. . . In many cases the efficiency is far less, as in level walking where the heat production rises to several 'mets' without the performance of any external work."

◆ ◆ ◆

The tremendous part arc welding is playing in the war effort of the Union of South Africa has been recognized by the issuance of a special postage stamp depicting a welder using modern shielded electric arc equipment and dressed in protective head shield and special clothing. (Photo courtesy Lincoln Electric Co.)



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D. Robert Yarnall, mechanical engineer of Philadelphia, Pa., was selected as the fifth recipient of the Hoover medal. The medal is being presented to Mr. Yarnall during the annual meeting of the American Society of Mechanical Engineers with the following citation: "D. Robert Yarnall, humanitarian, engineer, and a leader in the engineering profession, who rendered outstanding service as a member of a mission that fed the children of Germany at the end of the World War and that is now aiding refugees in this country and Europe and providing food and relief for the children and mothers of France. These distinguished public services have earned for him the Hoover medal for 1941."

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REJECTS SUGGESTION TO SUSPEND EXHIBITION

Voting down a suggestion to suspend the fourth all-industry refrigeration and air conditioning exhibition, the board of directors of the Refrigeration Equipment Manufacturers Association announced definitely last month that the show will be held in the Stevens hotel, Chicago, January 12-15. The directors declared that such industrial expositions are as necessary today as during normal times.

Quoting President Roosevelt's recent statement that "Wherever people congregate, the story of defense must be presented," the board announced that the exhibition would show the industry's part both in military and civilian defense.

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The United States Insulation Board Export Association has filed papers under the export trade act (Webb-Pomerene law) with the Federal Trade Commission, for exporting insulation board. The association will maintain an office at 55 W. 42nd St., New York. Officers are B. G. Dahlberg, president and director; J. A. Sampson, secretary and treasurer; J. C. Best, C. H. Nance and Frank H. West, directors. Members are the Celotex Corp., Hawaiian Cane Products, Ltd., the Insulite Co. and National Gypsum Co.

CONVECTOR RATING CODE FORMULATED

In order to protect the interests of the public as well as the industry, and to conserve critical defense materials, manufacturers of cast iron and non-ferrous convectors have adopted a proposed code for the testing and rating of convectors, which was formulated by a joint committee and accepted by engineers representing the various manufacturers. Manufacturers are running tests to determine if the code is adequate, after which it is planned to request the National Bureau of Standards to incorporate the code in a commercial standard.

The code is designed to serve the purpose of solving problems which have existed over a long period in connection with determining the output of convectors, both cast iron and non-ferrous, says R. E. Ferry, secretary of the joint committee.

Among the most important of these problems are:

Engineers have not reached agreement as to whether convector output or rating should be determined strictly on condensation and water heat capacity only, or whether other factors should also be considered.

The need for more precise standards covering the method of test and the laboratory equipment to be used.

The multiplicity of design variations which affect output in varying degree.

Lack of uniformity in the policy of specifying agents (government departments and others), as to accepting or discounting published catalog ratings.

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Permits for heating and power equipment installations issued by the city of Chicago for the first nine months of this year totaled 1134 as compared with 815 for the same period last year. Permits issued by the city for fuel burning installations cover commercial and large heating plants as well as high pressure installations. The city smoke department does not require permits for small apartment and residential heating installations.

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NAVAL ORDNANCE MATERIALS INSPECTORS STILL NEEDED

In June of this year the U. S. Civil Service Commission, Washington, D. C., announced that it was recruiting inspectors of naval ordnance materials. The examination announcement covering these positions was issued last month in revised form, covering positions paying from $1620 to $2600 a year and such optional branches as optical and fire control instruments, naval guns and accessories, munitions and ordnance units.

The requirements have been modified so that the successful completion of an appropriate approved national defense training course will meet the full requirements for the junior inspector grade. Courses such as the following are acceptable: materials inspection and testing, coordination course for ordnance inspectors, applied optics, geometrical optics and optical instruments, gaging and inspection methods, production inspection and quality control, and instrument design.

All other necessary information is contained in announcement No. 95 revised.

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Kalman Steiner, author of numerous articles on oil burning and handling and fuel conservation which have appeared in HPAC, has become consulting engineer with the Ray Heat & Power Co., Chicago.

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COMPRESSED AIR INSTITUTE ANNOUNCES PRIZE CONTEST

The Compressed Air Institute, 45 Warrington Pl., East Orange, N. J., has announced a nationwide essay contest for industry starting December 1 and closing June 1.

Articles submitted are to be judged according to the usefulness to the industry of the idea submitted; the originality of the text; the value of the text to the greatest number of industries; and the technical accuracy and completeness with which the subject is treated.

Subject matter may deal with anything of particular interest to the compressed air industry. Any phase or aspect of compressed air application may be treated, including its production, transmission or uses. Any type of pneumatic process or equipment may be described, including all kinds of pneumatic tools, air hoists and motors, rock drills, and air compressors of any type. Any process using compressed air alone or in combination with other power will be suitable material on which to base an article for the contest.

Any entry which is particularly adaptable to defense work and the speeding up of the defense program, whether a prize winner or not, will be brought to the attention of the proper government agency, with full credit given the contestant.

FUNCTIONS OF FUELS COORDINATOR OUTLINED

President Roosevelt, in his letter of November 5 to Secretary of the Interior Ickes requesting him to act as "solid fuels coordinator for national defense," outlined the following as the duties of the post:

1) Obtain currently from the appropriate defense and other federal agencies, from the various states and their subdivisions, and from any other sources, private or governmental, information as to the military and civilian needs for solid fuels;

2) Obtain currently from the solid fuels industries and from any other sources, governmental or private, information relating to development, production, supply, availability, distribution, utilization, transportation and handling of solid fuels;

3) Make recommendations to the Supply Priorities and Allocations Board, the Office of Production Management, the Office of Price Administration, the transportation agencies of the federal government and to any other appropriate federal departments and agencies concerning measures relating to the production, storage, pooling, transportation, distribution, marketing and consumption of solid fuels for the purpose of promoting the maintenance of a ready and adequate supply at reasonable prices;

4) In cooperation with the solid fuels and related industries and with consumers of solid fuels, and in coordination with the Office of Production Management, carry on such programs as will promote economy and efficiency in the development, production, distribution, utilization, transportation and handling of solid fuels, and as will facilitate the operation of the solid fuels industries so as to meet the requirements of the national defense program;

5) Advise and make recommendations to the Supply Priorities and Allocations Board, the Office of Production Management, and other appropriate defense agencies with respect to the material, equipment and supplies which will be required by the solid fuels industries in producing, transporting, and distributing the tonnage needed for civilian and defense purposes;

6) Make other recommendations to appropriate federal departments and agencies concerning measures affecting the supply and availability of solid fuels as may seem necessary from time to time.

Heating·Piping and Air Conditioning

with which is merged the "Aerologist"

Design • Installation
Operation • Maintenance

Commercial, Industrial
and Large Buildings

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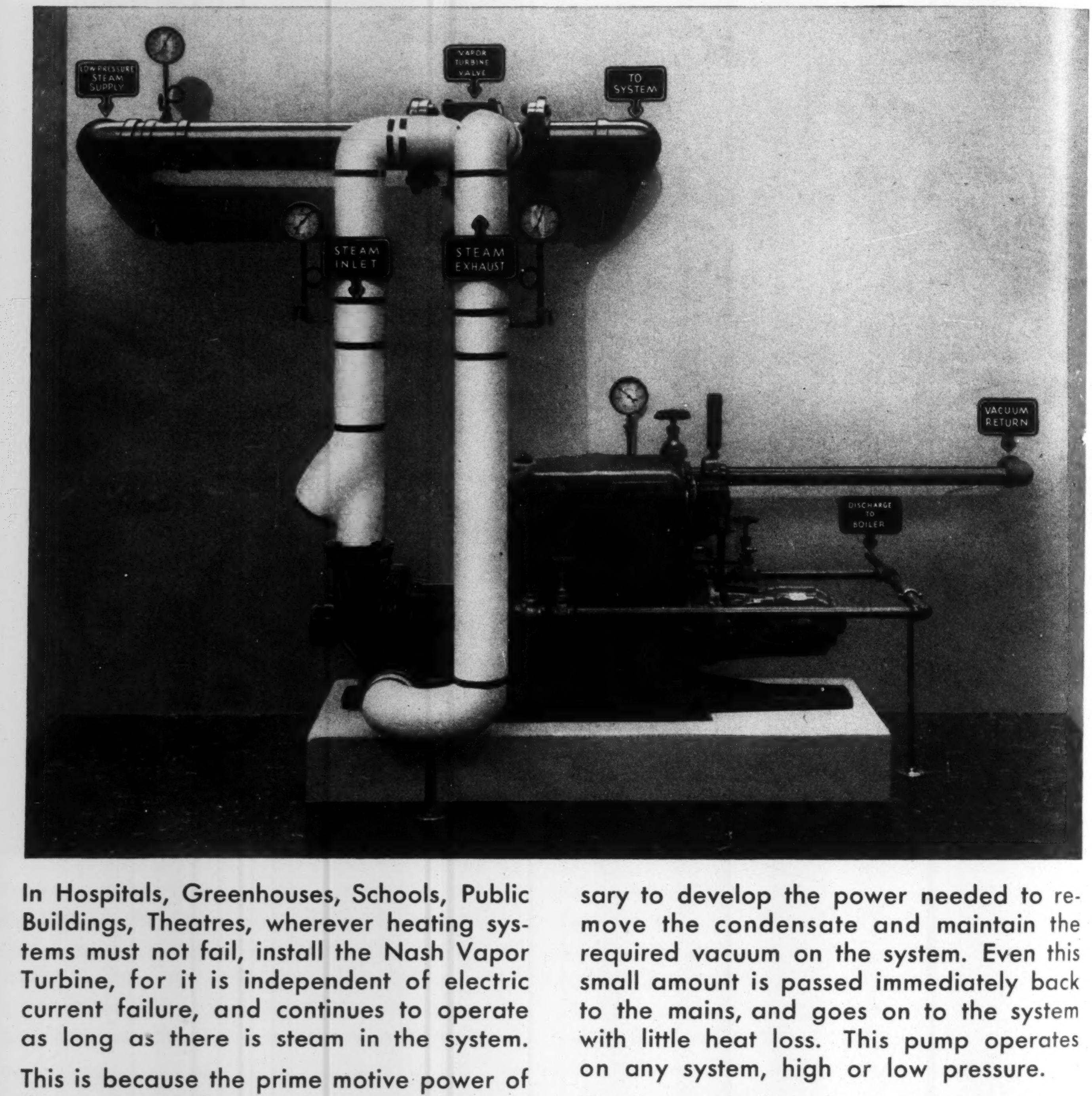
Where Heat Must Not Fail— Install this SAFE Heating Pump!



In Hospitals, Greenhouses, Schools, Public Buildings, Theatres, wherever heating systems must not fail, install the Nash Vapor Turbine, for it is independent of electric current failure, and continues to operate as long as there is steam in the system.

This is because the prime motive power of this economical pump is a special steam turbine, controlled by a unique "Vapor Turbine Valve", which automatically bypasses from the heating main a small portion of steam, the exact amount necessary to develop the power needed to remove the condensate and maintain the required vacuum on the system. Even this small amount is passed immediately back to the mains, and goes on to the system with little heat loss. This pump operates on any system, high or low pressure.

The Vapor Turbine is a most economical pump, for the elimination of electric current does away with current cost, the largest single item in the operation of an ordinary return line heating pump. Bulletin on request.

THE NASH ENGINEERING COMPANY
205-A WILSON ROAD, SOUTH NORWALK, CONNECTICUT, U. S. A.

The decibel unit has come into widespread use for rating the noise level of heating and air conditioning equipment. Here, the noise levels of a propeller fan are being taken

NOISE LEVELS—

How to Figure Them

Convenient Tables Simplify Computation of Decibel Noise Levels . . . . By William Goodman

NOISE LEVELS — There is frequently confusion as to how to use the decibel rating of mechanical equipment to determine the decibel noise level that will result in a room when the equipment is running. The noise level rating of equipment in decibels cannot be added directly to the decibel noise level of a room; instead a somewhat cumbersome computation is necessary. In this article by William Goodman, consulting engineer, The Trane Co., and member of HPAC's board of consulting and contributing editors, convenient tables are presented which enable the resulting noise level of a room to be quickly computed if the noise level of the equipment and the original noise level of the room are known. In addition, the examples not only show how computations can be made easily, but also illustrate some interesting facts concerning the effect which the equipment has on room noise levels

ALTHOUGH the decibel unit has come into widespread use for rating the noise level of equipment, there is, in general, some unfamiliarity with the method of applying these noise level ratings to determine their effect on the noise levels in rooms. To permit the effect of equipment noise on the room noise level to be easily and quickly computed, and to eliminate the need of involved computations, Tables 1 and 2 have been prepared.

The data in Tables 1 and 2 can be used to compute the resulting total noise level in a room if both the noise level of the equipment and the original noise level of the room are known. Obviously, if equipment is placed in a room, the resulting noise level of the room will be raised to a point that is higher than the noise level of either the equipment or the room alone. Table 1 is used when the equipment noise level is greater than the room level; Table 2, when the room noise level is greater than the equipment level.

Example 1—A room has a noise level of 37 decibels. Equipment with a noise rating of 43 decibels is to be placed in the room. Find the resulting noise level in the room.

Copyright, 1941, by William Goodman.

Table 1—*E* Greater Than *R*. Use to find total noise level when room and equipment noise levels are known

$(E - R)$	$(T - R)$
0	3.0
1	3.5
2	4.1
3	4.8
4	5.5
5	6.2
6	7.0
7	7.8
8	8.6
9	9.5
10	10.4
11	11.3
12	12.2
13	13.2
14	14.2
15	15.1
16	16.1
17	17.1
18	18.1
19	19.1
20	20.0

E is equipment noise level, *R* is original room noise level, and *T* is resulting total noise level, each in decibels.

Solution: $E - R = 43 - 37 = 6$ decibels.

Referring to Table 1, for a difference of 6 decibels, $T - R = 7$ decibels.

$T = 7 + 37 = 44$ decibels, the resulting noise level in the room.

Example 2—A room has a noise level of 52 decibels. An air conditioning unit with a rating of 45 decibels is to be placed in the room. Find the resulting noise level in the room.

Solution: $R - E = 52 - 45 = 7$ decibels.

Referring to Table 2, for a difference of 7 decibels, $T - R = 0.8$.

$T = 0.8 + 52 = 52.8$ decibels, the resulting noise level in the room.

Notice in Table 1 that when the difference between the equipment and room noise levels is zero—that is, when both noise levels are the same—the resulting noise level in the room will be increased by only 3 decibels when the equipment is running. In other words, when two equal noise levels are superimposed, the resulting noise level is 3 decibels higher than either one of the original noise levels alone.

Notice in example 2 that the resulting total noise level is only 0.8 decibels greater than the room noise level. Also notice in Table 2 that as the difference between the room and equipment noise levels increases, the difference betwen the resulting total noise level and the original room level decreases. Table 2 shows that when the difference between the room and equipment noise levels is as great as 20 decibels, the resulting total noise level will be substantially the same as the original noise level in the room. This is quite in agreement with the noise sensation of human beings. The increase in the noise level when a fan is started in a boiler factory could hardly be detected.

If several pieces of equipment are to be placed in a room, it would first be necessary to find the resulting noise level of all of the equipment. This resulting noise level of the equipment can then be combined with the original room noise level to determine the noise level that will result in the room when all of the equipment is running.

Table 2—*R* Greater Than *E*. Use to find total noise level when room and equipment noise levels are known

$(R - E)$	$(T - R)$
0	3.0
1	2.5
2	2.1
3	1.8
4	1.5
5	1.2
6	1.0
7	0.8
8	0.6
9	0.5
10	0.4
11	0.3
12	0.2
13	0.2
14	0.2
15	0.1
16	0.1
17	0.1
18	0.1
19	0.1
20	0

E is equipment noise level, *R* is original room noise level, and *T* is resulting total noise level, each in decibels.

Example 3—Three pieces of equipment each having a noise rating of 40 decibels are to be placed in a room whose original noise level is 35 decibels. Find the resulting noise level in the room.

Solution: Inasmuch as the noise level of each piece of equipment is the same, the resulting noise level of two pieces of equipment will be 3 decibels higher than the noise level of one piece of equipment alone, or 43 decibels.

The noise level of the two units, which is 43 decibels, must now be combined with the noise level of the third unit which is 40 decibels. *For this case only,* let *R* designate the noise level of the third unit. Consequently, $E - R = 43 - 40 = 3$ decibels. From Table 1, $T - R = 4.8$ decibels. Therefore, the noise level of the three units $\doteq 40 + 4.8 = 44.8$ decibels.

The equipment noise level must now be combined with the room noise level to obtain the resulting total noise level in the room. Using *R* now to designate the original room level, $E - R = 44.$ $- 35 = 9.8$ decibels (or, say, 10 decibels). Referring to Table 1, $T - R =$ 10.4 decibels.

Therefore, the resulting room noise level $= 35 + 10.4 = 45.4$ decibels.

Testing Equipment

When testing equipment to determine its decibel rating, the test must occasionally be run in noisy rooms. In this case, the room noise level with the equipment off is found first, and then the total noise level is determined. With these two noise levels known, Table 3 can be used to determine the noise level rating of the equipment alone. In general, the results of this type of test must be used with caution as they can be highly misleading. This is particularly true when the difference between the total and room noise levels is small. As can be seen in Table 3, in this case the difference between the equipment and room noise level changes very rapidly. The following example illustrates the method of using Table 3 to determine the noise rating of equipment.

Example 4—With a motor-driven unit running, the total noise level in a room is 47 decibels. With the equipment off, the noise level of the room is 41 decibels. Determine the noise level of the equipment alone.

Solution: $T - R = 47 - 41 = 6$ deci-

Table 3—Use to find equipment noise level when total and room noise levels are known

$(T - R)$	$(E - R)$
0	$-\infty$
1	-5.9
2	-2.3
3	0
4	1.8
5	3.3
6	4.7
7	6.0
8	7.3
9	8.4
10	9.5
11	10.6
12	11.7
13	12.8
14	13.8
15	14.9
16	15.9
17	16.9
18	17.9
19	18.9
20	20.0

E is equipment noise level, *R* is original room noise level, and *T* is resulting total noise level, each in decibels.

Symbols

E = equipment noise level, decibels;
I_E = equipment sound intensity;
I_R = room sound intensity;
I_T = total sound intensity;
R = original room noise level, decibels;
T = resulting total noise level, decibels.

Typical Noise Levels

Rooms	Noise Level in Decibels to be Anticipated		
	Min.	Representative	Max.
Sound Film Studios	10	14	20
Radio Broadcasting Studios	10	14	20
Planetarium	15	20	25
Residence, Apartments, etc.	33	40	48
Theaters, Legitimate	25	30	35
Theaters, Motion Picture	30	35	40
Auditoriums, Concert Halls, etc.	25	30	40
Churches	25	30	35
Executive Offices, Acoustically Treated Private Offices	30	38	45
Private Offices, Acoustically Untreated	35	43	50
General Offices	50	60	70
Hospitals	25	40	55
Class Rooms	30	35	45
Libraries, Museums, Art Galleries	30	40	45
Public Buildings, Court Houses, Post Offices, etc.	45	55	60
Small Stores	40	50	60
Upper Floors Department Stores	40	50	55
Stores, General, Including Main Floor Dept. Stores	50	60	70
Hotel Dining Rooms	40	50	60
Restaurants and Cafeterias	50	60	70
Banking Rooms	50	55	60
Factories	65	77	90
Office Machine Rooms	60	70	80
Vehicles			
Railroad Coach	60[a]	70	80
Pullman Car	55[a]	65	75
Automobile	50	65	80
Vehicular Tunnel	75	85	95
Airplane	80	85	100

[a]For train standing in station a level of about 45 db is the maximum which can ordinarily be tolerated.

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bels. Referring to Table 3, for 6 decibels, $E - R = 4.7$ decibels. Therefore, decibel rating of equipment alone $= 41 + 4.7 = 45.7$ decibels.

When using Tables 1, 2 and 3, it is well to remember that the human ear cannot, in general, detect changes in noise levels of less than approximately 1 decibel. Because of the difficulty of making accurate noise level readings in the field, all computations involving noise ratings must be used with caution.

Computing Tables

By definition, the difference in noise levels in decibels is

$$T - R = 10 \log \frac{I_T}{I_R} \quad \ldots\ldots [1]$$

Sound intensities are additive:

$$I_T = I_E + I_R \quad \ldots\ldots\ldots\ldots [2]$$

Substituting (2) into (1),

$$T - R = 10 \log \frac{I_E + I_R}{I_R} \quad \ldots\ldots [3]$$

$$= 10 \log \left(\frac{I_E}{I_R} + 1 \right) \quad ..[4]$$

But

$$E - R = 10 \log \frac{I_E}{I_R} \quad \ldots\ldots [5]$$

$$\frac{E - R}{10} = \log \frac{I_E}{I_R} \quad \ldots\ldots\ldots [6]$$

$$\frac{I_E}{I_R} = 10^{\frac{E-R}{10}} \quad \ldots\ldots\ldots\ldots [7]$$

Substituting (7) into (4), the following equation is obtained.

$$T - R = 10 \log \left[10^{\frac{E-R}{10}} + 1 \right] \quad ..[8]$$

Equation 8 was used for computing the three tables.

Erection of the heavily insulated acoustic side walls is progressing rapidly in this view of the Fort Worth aircraft assembly plant, where fiber glass and steel products are being employed to insure working comfort and operating efficiency in an air conditioned, windowless layout comprising 2,000,000 sq ft of floor space.

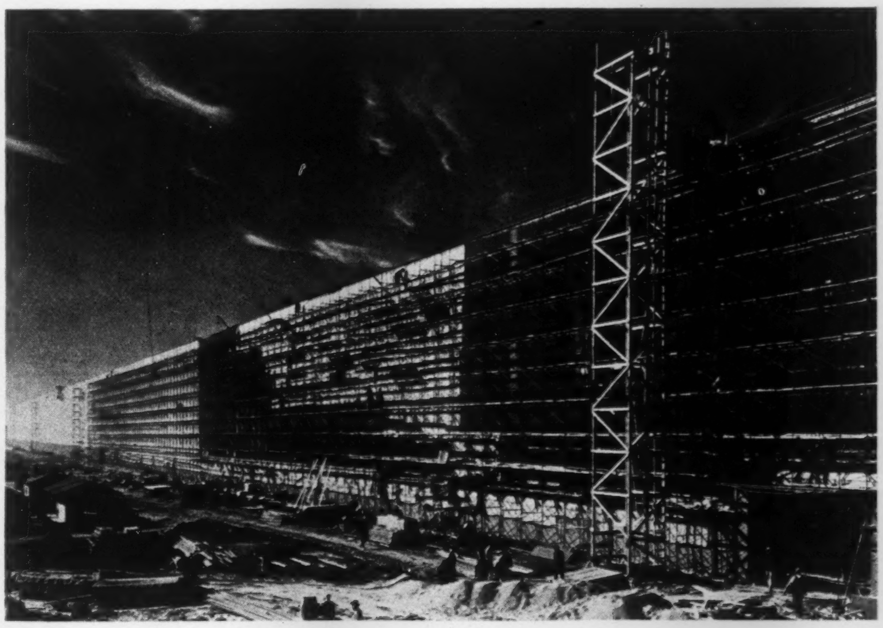
A 1000 ft section of the finished wall can be seen on the extreme left, where some scaffolding is still in place, pending the completion of expansion joints which are being provided every 400 ft. Successive stages in the erection and finishing of the wall are seen from right to left.

The first stage in enclosing the wall is seen immediately to the left of the hoist, where steel channel sections have been erected. These are lined on the inside by 3 in. of fiber glass, which is covered in turn by a thin, dustproof fiber glass mat and expanded metal lath to hold these acoustic insulating materials in place. The lighter area in the center shows how these panels look after they have been mopped with asphalt and covered with vaporproof paper.

Fiber glass insulating board is placed outside this vapor seal and is then covered by the ribbed steel facing panels which are bolted in place and sealed vertically by a mastic. They constitute the building's outer shell. Painters, working from the scaffolding to the left, are applying two coats of paint required to finish the exterior.

The Fort Worth plant, which Consolidated Aircraft Corp. will operate, and its twin at Tulsa, Okla., were designed by the Austin Co., which is also building the Fort Worth plant.

Despite the insulated type of construction used, these plants are so large that 7000 tons of refrigeration will be required for air conditioning each of them.



MEASURING AIR FLOW

At Intake (or Exhaust) Grilles

Tests Made by G. L. Tuve Give Factors and Recommendations for Proper Use of New Attachment for Air Velocity Meters

In a paper on air flow measurements at intake and discharge openings and grilles, by G. L. Tuve and D. K. Wright, Jr., professor of heat-power engineering and instructor in mechanical engineering, respectively, at Case School of Applied Science, [published in the ASHVE Journal Section, HEATING, PIPING AND AIR CONDITIONING, August, 1940] mention was made of the inability of the pitot tube, and the swinging vane type of direct reading air velocity meter with the jets then available, to give satisfactory and accurate readings at intake (or exhaust) openings or grilles because of the rapid change from static to velocity pressure which occurs in or near the intake. Since that time, a new jet for the swinging vane instrument has been developed which overcomes this difficulty. This article presents the results of tests and conclusions made by Professor Tuve on the performance of the new jet attachment for making air flow measurements at intake grilles. The data supplement those given in the above-mentioned paper.

MEASURING AIR FLOW at intake (or exhaust) grilles presents a difficult problem because of the rapid change from static to velocity pressure which occurs in or near the intake. A new type of jet attachment for the swinging vane type of direct reading air velocity meter has, however, been developed which—according to the tests reported here—may be used for accurate results . . . The air volume reading is obtained by multiplying the velocity meter reading by the area of the intake and by an application factor . . .The tests showed that a traverse of the intake is the more accurate, but as the difference between a traverse and a spot center reading is less than 1 per cent, the use of the center reading is justified in most cases. It is important, however, that enough center readings be taken to secure a good average, since individual readings may be off 10 per cent

The new intake (or exhaust) grille jet developed for use with the swinging vane type of direct reading air velocity meter has two calibrated air intake openings. One of these openings is at the end of the main member, and this member forms a compensating tube and extends from the grille face outward from or beyond the critical suction zone—that is, the zone where the air pressure changes most rapidly from static to velocity. At right angles to this main member is a branch tube, also calibrated, to which is attached the flexible tube connecting the jet to the velocity meter. The air actuating the meter movement is inspirated through this branch tube by the force of the suction exerted upon the main member or compensating tube.

The test unit consisted of a fan with infinite-step speed control, drawing air from a 24 in. test duct and discharging the air to a large plenum chamber. The test grilles were mounted at the intake end of the 24 in. duct, and the air was metered by discharging to atmosphere through calibrated nozzles and orifices in the wall of the plenum chamber. Calibrations were carefully made by pitot tube traverses and by orifice and nozzle comparisons (metering the air at both intake and discharge). Careful leakage tests were made at intervals, and the small corrections applied.

Test Methods

Two kinds of velocity meter readings were taken: (1) Traverse readings in 3 in. to 5 in. squares, over the entire grille face. (2) Readings in the center of the grille only (average of four readings). Each traverse was usually repeated with each of the three instruments used.

The jet itself was mounted on an extension handle to prevent any possible interference with the air stream. Observer and instrument were outside the air stream. Velocity meter and air meter readings were made simultaneously by two observers.

The grille sizes used in these tests were as follows: (1) Square punched grille—14 x 6, 14 x 10, 18 x 10, 18 x 18, 24 x 24. (2) Bar grille—10 x 4, 14 x 6, 18 x 10, 18 x 18. (3) Steel strip grille, concealing type—10 x 4, 14 x 6, 18 x 10, 18 x 18.

Results

This report covers the results obtained from about 170 sets of traverses or a total of about 3200 velocity meter observations. Corrections were made for air density and temperature.

Average Total Error—An analysis of all test results shows that with the traverse method, the *average* error is about 2.0 per cent of full-scale reading. The error is less than 3.5 per cent of full-scale reading if the velocity is measured at the center of the grille only. In both cases it is assumed that an average "velocity meter application factor" will be applied to the actual reading, before the error is computed. Included in this percentage error are the errors of application and use, the personal errors of the observer, and a probable inaccuracy of 0.5 per cent in the metering of the air in these calibration tests.

Errors of Instrument Only—The chief limitation of the instrument is due to the short length of the scale, and to the compression of the scale in the low range. Another characteristic of the instrument which limits its accuracy is the fluctuation of the pointer due to the pulsation of the air stream. Measurement of these pulsations, however, may in some cases be desirable to show actual air conditions. If all *other* features of the instrument and the jets were perfect, it is doubtful whether single velocity readings could possibly be made closer than 3 to 5 per cent in the range below 500 fpm unless the direct reading air velocity meter has an intermediate range or as low a range as will cover the velocities to be measured.

A linear error of 1/50 in. or 0.02 in. in reading the scale must certainly be allowed. For a scale length of 2500 fpm, 1 per cent of full-scale reading represents 25 fpm, which is not a large error on the higher velocity readings, but it is, nevertheless, a large error in the lower velocities. With an intermediate scale of 1500 fpm, this percentage would be considerably reduced. With the lower range, the compression of the scale at the low end would be of less consequence.

Taking a traverse across the grille, or averaging several readings, will of course reduce the error, but an average error of 1 per cent of full scale deflection must be expected from these two instrument limitations—that is, the short scale and the fluctuations of the indicating hand. Additional instrument errors are due to imperfections in the jets, error in marking the scale calibrations, etc.

Table 1—Effect of Grille Size on Accuracy of Direct Reading Air Velocity Meter

Grille Size, In.	No. of Tests	Mean Deviation from Average Velocity Meter Application Factors, Per Cent	
		Traverse Readings	Center Readings
14x6	19	3.5	3.8
14x10	20	3.4	3.8
18x18	16	2.6	3.0

Effect of Air Velocity—The accuracy of the direct reading air velocity meter seems to be about the same at all air velocities, except that the error is a higher percentage at the low scale readings.

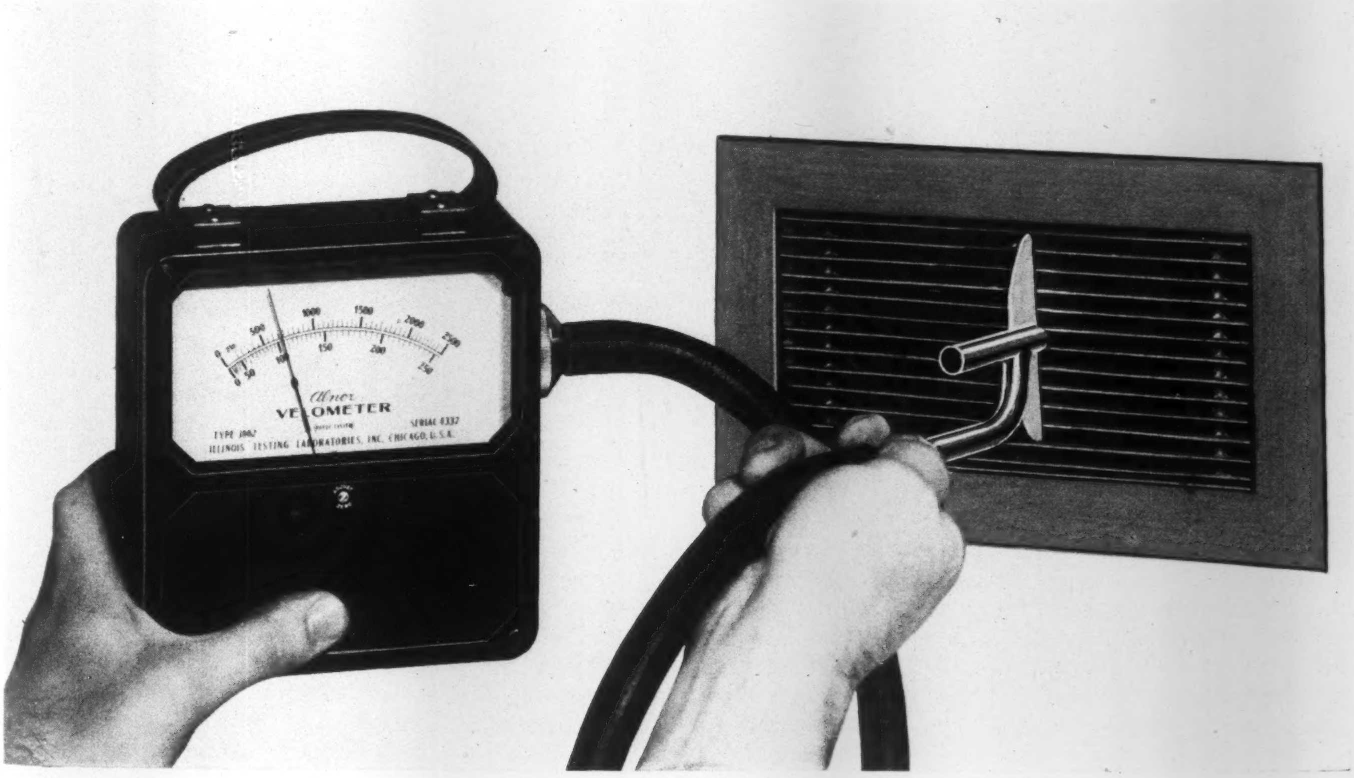
Effect of Grille Size—Table 1 shows the mean deviation from the average velocity meter factor for each of three grille sizes. From these results it appears that accuracy is about the same for the various grille sizes, and this was confirmed by the subsequent tests on other types of grilles. An interesting comparison is between the 14 x 6 grille and the 14 x 10, since the former was punched with ½ in. square holes while the latter had ¾ in. square holes.

Mean Velocity Meter Factor—The averages of all the velocity meter factors for each instrument are shown in Table 2. From a comparison of Tables 1 and 2 it appears that an average factor for all grille sizes is just as accurate as a special factor for each grille size. In other words, the average of the errors or deviations in individual tests was between 3 and 5 per cent of the mean reading, irrespective of the grille size and irrespective of which of three instruments was used. This means that the average error for the traverse method was about 2 per cent of the full-scale deflection.

How to Use

Tables 1 and 2 show that the traverse method is more accurate than the method of using center readings only. But since the difference between the two methods is less than

Swinging vane type of direct reading air velocity meter with jet for measuring air flow at intake (or exhaust) grilles, showing typical use



1 per cent in all cases, the use of center readings is justified for most tests. It is important however, that enough readings be taken to secure a good average, since individual readings are often in error by 10 per cent.

Summarizing the results of all tests, the following conclusions may be drawn:

1) The swinging vane type of direct reading air velocity meter with the new jet for intake or exhaust grilles may be used to measure air velocities and volumes at air intakes and return grilles, provided a factor is applied according to the type of grille used.

Table 2—Average Velocity Meter Application Factors (Meter Scaled 1500 Fpm)

Grille	Average Factors		Mean Deviation from Average Factors, Per Cent	
	Traverse	Center	Traverse	Center
Square Punched	0.88	0.90	2.8	2.8
Bar grille	0.78	0.78	3.8	3.6
Steel strip grille	0.73	0.71	3.4	4.0

NOTE: The mean deviation from average factors is computed as follows: (1) All factors for the group of tests under consideration are averaged, to obtain the average factors. (2) The percentage deviation of each individual factor from the average factor is computed. (3) The deviations are averaged without regard to sign, to obtain the mean deviation.

2) To obtain the air volume from the velocity meter, readings,

"QUOTED"

COOLING TOWERS

THE rapid growth of air conditioning, principally, led water cooling equipment manufacturers to design a new and better product because practically none of the equipment available at the start of this growth was satisfactory to the new and stiffer requirements. Most towers in air conditioning service are located on roofs in populous districts so that space is restricted, the weight which can be supported is frequently limited, and noise and drift moisture are usually highly objectionable. It is further necessary to obtain the maximum cooling efficiency during the hottest of summer weather and appearance is of great importance.

Mechanical draft towers were obviously indicated for such service since dependable high performance had to be maintained at all times regardless of breeze, but it was realized that noise, drift water, unsightliness, high power consumption and high first cost all combined to make the mechanical draft of those early days both a great expense and a great nuisance.

Recognizing these shortcomings, tower manufacturers began improving and simplifying their designs and details to reduce weight as well as cost and power requirements. Mechanical draft engineering advancement was so marked and continuous that the type has developed wide popularity for nearly all classes of water cooling work, and is today the most generally accepted means of water cooling. It is possible to design mechanical draft towers for almost any desired approach to the wet bulb and thus obtain longer cooling ranges and closer approaches under all conditions than is practical with any other style of cooling equipment.

The accepted standard in air conditioning work is 3 gpm per ton of refrigeration rather than 5 to 6 gpm as would be necessary with spray ponds. Even in steam power plant work condensers have been so improved and operating costs have become so important that cooling ranges of 15 to 18 deg, rather than 10 to 12 deg, as with spray ponds, are preferred.—L. T. MART, president, Marley Co., at the semi-annual meeting of the ASME.

PARACHUTES

AIR conditioning is playing an important role today in protecting parachutes of the U. S. army and navy against mildewing and rotting while in storage. Excess moisture in parachute storage rooms, it was found, affected materials in the parachutes while they were packed away awaiting use. To remove this moisture and keep temperatures and humidities in the storage rooms constant, air conditioning units were installed.

Five dehumidification units were installed recently at the naval air station at Corpus Christi, Texas. Each unit is capable of removing approximately 7 lb per hr of moisture from the air when the temperature hits 85 deg and relative humidity stands at 48 per cent.—EDWARD T. MURPHY, vice-president, Carrier Corp.

HOTEL HAPPY

AIR conditioning is playing an important part in the rehabilitation of the Hotel Bentley, Alexandria, La., according to Coleman J. Hudson, the general manager. Mr. Hudson says that after air conditioning and other modernizations were installed "Commercial travelers who formerly routed themselves so as not to stop here now route themselves so as to stay overnight.

"Our average room occupancy has increased 200 per cent and the returns per room average with it, and all of the other departments have increased in patronage in proportion," he added.

Mr. Hudson said the air conditioning draws customers to public rooms and that "people living in town are proud of the hotel and entertain guests here" instead of in their homes.

OBSOLETE

IN OUR company we have another new committee that is going to work, and its slogan is one which will probably make a good many of our conservative forebears the following calculations should be made:

$$V = R \times F \times A$$

where V = air volume, cfm; R = average velocity meter reading, fpm; F = application factor; and A = designated area, sq ft.

The designated area is the free-open area of punched grilles and the core area of bar grilles.

3) No special corrections are necessary for variations in grille size or in air velocity.

4) Application factors (F) are approximately as follows:

Square punched grille	0.88
Bar grille	0.78
Steel strip grille	0.73
Free open, no grille	1.00 (no correction)

These factors apply to traverse readings. Factors for spot center readings are given in Table 2. This shows the traverse method to be more accurate, but since the difference between the two methods is less than 1 per cent in all cases, the use of center readings is justified for most tests.

5) Accuracy of results depends on the number of readings taken and upon the original velocity meter calibration. Using the average of traverse readings, the results should be within 3 per cent for velocities above 400 fpm. To maintain this accuracy for lower velocities an intermediate or lower scale range instrument should be used.

These conclusions apply only to the range covered—4 in. to 24 in. grille sizes and velocities up to 1600 fpm.

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revolve in their resting places. That slogan is: Anything over 10 years old may be obsolete. It refers to methods of doing business, designs of equipment, engineering rules, methods of organization and operation, the voluminous reports to management with which you are all familiar, that great mountain of paper work which rides along on the shoulders of modern business. Each of these methods will be examined, and it must justify itself or be thrown out.

We hope to streamline ourselves for the task that is ahead. We are going to need all the streamlining that we can achieve, all the planning and all the foresight and all the courage, if we are going to take up the historic challenge to the American free enterprise system.—STUART M. CROCKER, vice-president, General Electric Co., in an address on planning for the post-war period.

HEALTHIER

A "MARKED decrease in absentees from illness" together with elimination of closings on hot summer afternoons, is reported by Guarantee Mutual Life Co., Omaha, Neb., as the result of its first year's experience with air conditioning of its entire five floor office building. J. E. Pickard, building manager, states: "The office had made a practice of closing at noon whenever the temperature inside the building rose above 90 deg. This occurrence every summer for the past number of years caused the office to be closed afternoons for as long as a week or 10 days at a time. This has been remedied since air conditioning."

While no overall records have been kept, Mr. Pickard reports "the records of one department of the office show a marked reduction in time lost because of illness."

The operating costs of the system are reported as only 8c per year per sq ft of space air conditioned. Consulting engineer on the installation was Charles S. Leopold.

PREDICTION

A COMPREHENSIVE survey of all air conditioned buildings and other large shelters in New York City, to uncover "necessary and vital information" in case of air attack, was advocated by D. A. Newton, air conditioning engineer of Carrier Corp., before a recent meeting of the New York building superintendents' association.

"In some large eastern cities, some surveys already have been made to find air conditioned auditoriums and buildings where large numbers of persons can be crowded together comfortably in case of possible air raids," Mr. Newton said.

Mr. Newton visualized air conditioned cities where "it will be possible to walk through the streets without noticing temperature differences regardless of whether it is zero outside or 110 degrees in the shade.

"Entire buildings, block after block of them, will be completely air conditioned, both summer and winter," Mr. Newton said. "As we walk from one building to another, it will be along pleasant sidewalks or arcades also entirely air conditioned.

"In a city like New York, huge power plants or central stations will house the refrigerating machinery capable of developing upwards of 100,000 tons of refrigeration daily," he continued. "From these stations, chilled water will be pumped to the various central station air conditioning systems just the same as steam or gas are today."

Mr. Newton pictured the city of the future as a network of "zones," in which sections of 10 blocks square, including interconnecting closed arcades, will constitute a central air conditioning system area.

"Air will be filtered, washed and circulated down through the section or zone and delivered to units in the thousands of individual rooms," he told the superintendents. "This conditioned air will induce room air over coils through which chilled water is circulated in summer and warm water in winter. The temperature of each room will be under the control of the person in the room."

Many people wonder about the cost of such "seemingly impossible projects," thousands of times larger than any air conditioning systems and refrigerating plants in use today, Mr. Newton said. He estimated that mass human comfort in the future will cost less than it does today.

"It has been calculated that among the large present day installations, the cost is less than $15 a year per person. On the installations of the future, many times larger, the cost per person will be lower."

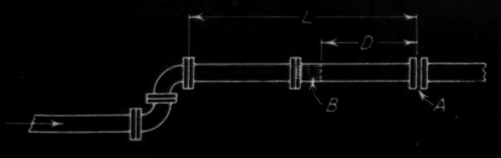


Fig. 1—Head Meter Preceded by One or Two Elbows in One Plane

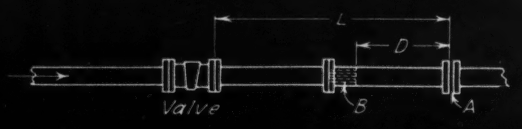
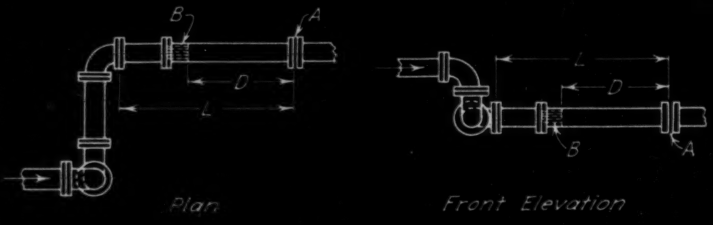


Fig. 3—Head Meter Preceded by Some Form of Valve



Plan

Front Elevation

Fig. 2—Head Meter Preceded by Two or Three Elbows in Two or Three Mutually Perpendicular Planes

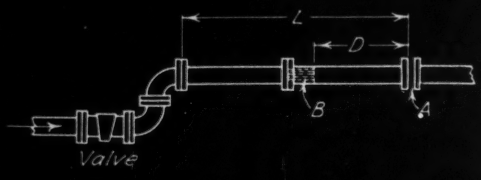


Fig. 4—Head Meter Preceded by a Valve With One or Two Intervening Elbows

NOTES

A = Flanges for holding orifice plate or flow nozzle
B = Straightening vanes, if used
L = Length of straight pipe, (with venturi tubes, the distance L was measured from the face of the inlet flange)
D = Distance to vanes

Installation Requirements for HEAD METERS

Howard S. Bean of National Bureau of Standards Summarizes Test Data on Effects of Installation Conditions on Head Meters and Shows the Lengths of Straight Pipe Which Should Precede the Meter

THE possible variations in piping arrangements preceding a head meter are of course limitless. However, for most practical purposes it is possible to group such arrangements under one of the following (1) When the differential producer is preceded by one elbow, or two elbows in a common plane, as shown by Fig. 1. (2) When the differential producer is preceded by three elbows which determine three mutually perpendicular planes, as shown by Fig. 2. (3) When the differential producer is preceded by some form of pressure or flow control, such as a gate valve, plug valve or pressure regulator, as in Fig. 3. A possible fourth arrangement would be a combination of (3) with either (1) or (2), as shown in Fig. 4.

In preparing this review, an attempt was made to determine the length of straight pipe (*L* in Figs. 1 to 4) which should precede the differential producer if the effects of installation are not to exceed ½ of 1 per cent. Also, while the original test results show that the installation effect may be either plus or minus—that is, the meter indications may be either fast or slow—no attention has been paid to the direc-

HEAD METERS — The results of tests from four different sources on the effects that installation conditions may have upon the indications of head meters are reviewed and summarized here by Howard S. Bean of the National Bureau of Standards. The summarized results have been combined so as to give the lengths of straight pipe that should precede the differential producer of a head meter, for three different basic arrangements of piping. These lengths are given in the form of curves plotted as a function of the diameter ratio. It is pointed out that if the lengths given by these curves are used, the effects of installation conditions probably will not exceed one-half of one per cent, and may be less

Sources of Data

In preparing this summary the data from the following tests have been reviewed:

a) The disturbance tests made by the gas measurement committee of the Natural Gas Association of America (now the natural gas section of the American Gas Association) in the summers of 1926 and 1927, at the Daly measurement station near Buffalo, N. Y. Both 8 in. and 4 in. pipe were used, and all tests were made with natural gas.

b) Tests made for the gas measurement committee by several meter manufacturers on such elements as orifice edge rounding and chambering in the orifice flange. Most of these tests were made with air in 4 in. pipe.

c) Tests made during 1939 and 1940 at the East Station of the Washington Gas Light Co. and in the hydraulic laboratory of the National Bureau of Standards, under the sponsorship of the special research committee on fluid meters of the American Society of Mechanical Engineers. These tests were made in 4 in. pipe with both air and water. Also, flow nozzles and venturi tubes were used as differential producers as well as square edged orifices.

The data from the tests of (a) and (b) are printed in the report of the joint AGA-ASME committee on orifice coefficients. (See also the ASME publication: The History of Orifice Meters, and the Calibration, Construction and Operation of Orifices for Metering; and Report No. 2 of the gas measurement committee, natural gas section, American Gas Association.) The data from group (c) have not been reported before in a separate paper.

In addition to these there are the 1930 paper of R. Witte (Durchflusszahlen von Dusen und Stauranden, Tech. Mech. u. Thermodyn., Band 1, 1930, Heft 1, 2, 3) in which he gives the results of some installation effects upon nozzles and orifices, and a paper by Professor W. S. Pardoe on installation effects on venturi tubes (Effects of Installation on Coefficients of Venturi Meters, Transactions, ASME, November, 1936, p. 677).

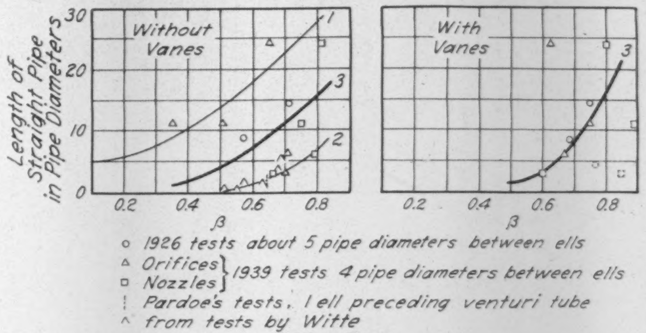


Fig. 5—

Lengths of Straight Pipe that should be Used between Head Meter and Nearest Fitting Upstream when Metering Element is Preceded by Two Elbows in the Same Plane

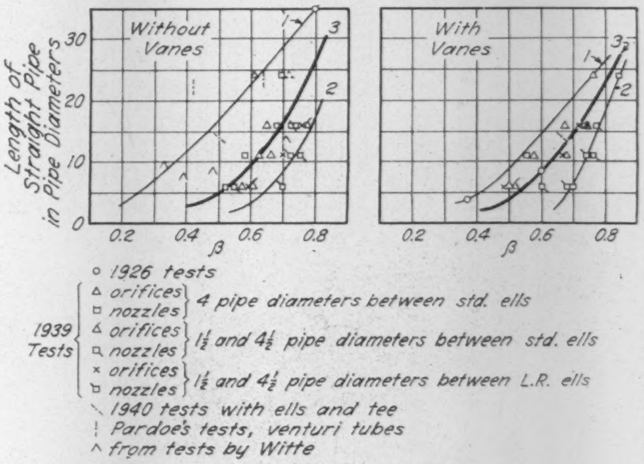


Fig. 6—

Lengths of Straight Pipe that should be Used between Head Meter and Nearest Fitting Upstream when Metering Element is Preceded by 2 or 3 Elbows in Planes Perpendicular to each Other

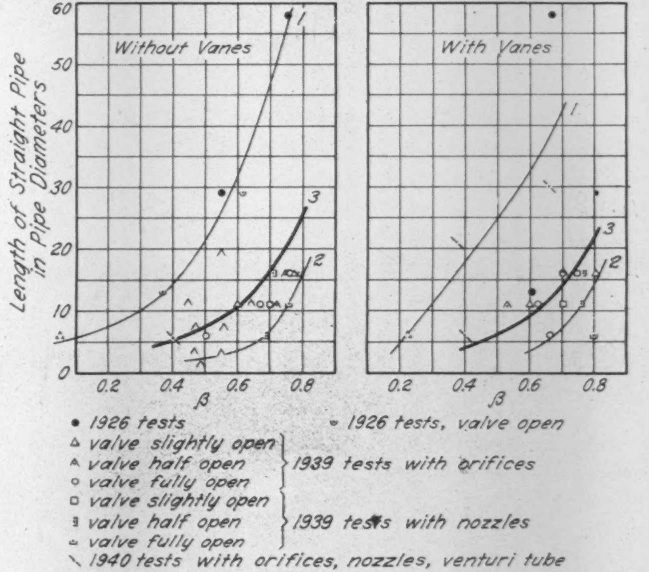


Fig. 7—

Lengths of Straight Pipe that should be Used between Head Meter and Nearest Fitting Upstream when Metering Element is Preceded by a Gate Valve, Globe Valve, or Pressure Regulator

NOTES

Line 1 Maximum Requirement Line 2 Minimum Requirement

Line 3 Suggested Requirement for Average Conditions

β denotes diameter ratio – that is, diameter of the orifice (or the flow nozzle or venturi throat) divided by the inlet pipe diameter.

tion of the effect in preparing the conclusions. This has been done because we are concerned only with the magnitude of the effect.

The curves in Figs. 5, 6 and 7 show the lengths of straight pipe that should precede the differential producer of a head meter for the three installation arrangements listed above. As indicated above, the points represent combinations of diameter ratio and pipe length at which the installation effects have diminished to 0.5 per cent. Hence the curves in these figures do not show the lengths of pipe which would be required for *no effect* from the installation, but only the lengths with which the effects probably will not exceed 0.5 per cent. However, in the general use of head meters, an uncertainty of 0.5 per cent is not usually considered excessive. Unfortunately there is no way of foretelling whether the installation effect—if there is any—aggravates or neutralizes the uncertainty from some other source.

Use of Data

From the scattering of the points in Figs. 5, 6 and 7, it is evident that the effects from installation conditions are very variable. For this reason three lines have been drawn representing the maximum, minimum and average requirements. Also, because of the variableness of these effects, no set rules can be given to govern the selection of the proper line by which to determine the straight pipe length. However, the following suggestions and comments may be helpful.

Fuel Gas—Wherever space permits, use the maximum requirement, or more if possible. As an example, in the metering of fuel gas with head meters (generally orifices) there is usually enough room at the meter location so that this recommendation can be followed readily.

Power Piping—In power plants it is not always convenient or possible to provide the lengths of straight pipe corresponding to the maximum requirement. In such cases the piping layout should be carefully planned so as to provide as much straight pipe ahead of the meter as possible. Also, long radius bends should be used if possible instead of standard short radius elbows, and if these have to be in more than one plane, there seems to be some advantage, where there are three or more bends, in having the distances between the bends of unequal length. Where long radius bends or pipe bends are used it will probably be fairly safe to use the minimum length lines shown in Figs. 5 and 6.

Valves—If possible, valves of any kind and for whatever purpose should be located after and not before a head meter—for, as shown in Fig. 7, even a wide open plug valve has some effect upon the meter indications. Placing one or two elbows between a valve and the differential producer, as in Fig. 4, appears to reduce the effect of the valve, but not to the level of the two elbows alone.

Orifice vs. Nozzle—As to which type of differential producer is the more affected by the installation conditions, it will be seen by the test points in Figs. 5, 6 and 7 that there are more cases in which the orifice points are to the left of the nozzle points than the reverse. To this extent it would appear that a square edged orifice is somewhat more affected than a flow nozzle. However, there are several exceptions to this, and from the scattering of the test points it does not seem to me that we would be justified in setting that down as a final conclusion at this time. Moreover, the points in these figures were read from other curves, in the drawing of which there was more or less variation possible, and the data for venturi tubes are too meager to justify any comparison concerning them. For these reasons, therefore, I believe it better at this time to make no distinction between the three forms of primary elements as far as installation requirements are concerned.

HOW OFTEN SHOULD WATER IN AIR CONDITIONING SYSTEM BE CHANGED?

Will you please let me know what the general practice is for the following operation?

How often should the water be drained from the chilled water circuit of an air conditioning system of 10 air washers in daily use for eight hours, and be renewed with fresh water?

Also, how often should water be changed for the condenser water circuit?

What pH value should be maintained for the above two water circuits?—J. A. V.

1) The chilled water in an air washer circuit should be changed when it becomes dirty or odorous. It is being changed constantly at a slow rate due to the condensate added by the dehumidifying process or loss by evaporation. The speed of contamination depends upon the quality of the entering air.

2) The condenser water requires changing if it gets dirty. The speed of contamination also is governed by the cleanliness of the air flowing through the cooling tower or evaporative condenser. Some new water constantly is being added to replace loss by drift and by evaporation. The hardness or quality of the make-up water is a factor which may require attention.

3) The pH value should not be below 7. In other words, the water always should be maintained slightly alkaline. In many installations of refrigeration in connection with air conditioning, there is no complete wasting of all of the condenser water until the end of the cooling season, when the cooling tower basin is drained to prevent damage by freezing.

Other installations in connection with year 'round commercial refrigeration require complete replacing of the water in summer as often as every three weeks and in winter every six to eight weeks.

Ozone has been used successfully to combat odors and to retard bacterial growth in air washers. Chlorine is used in other installations in the condenser water circuit for the same purpose, the required concentration being of the order of one-half part free chlorine per million.

Usage and operating conditions for each installation generally will provide individual problems which require individual solutions; hence no general rule can be applied.—Samuel R. Lewis, consulting mechanical engineer, and member of HPAC's board of consulting and contributing editors.

The Priorities Picture

. . . NEWS OF RECENT PRIORITY ORDERS WHICH AFFECT HEATING, PIPING AND AIR CONDITIONING

ALLOCATIONS—Preparation for the allocation of all critical materials throughout American industry was called for November 7 in parallel actions by the Supply Priorities and Allocations Board and the Office of Production Management. In setting its sights for this all-out allocation program, SPAB laid down the principle that where feasible the allocation programs should be developed in such a way that minimum quantities of the needed materials would be assured to essential industries whose operations are curtailed. In substance, the development of an allocation program will proceed roughly as follows: (1) An industrial branch in OPM takes the first step, calling on its several sections to develop requirements programs for each industry which manufactures the products for which the branch is responsible. (2) Each program is built up by the branch or by its section, through consultation with the industry advisory committee involved and also through discussion with either or both of the armed services, depending on the nature of the product and the materials used in its manufacture. (3) When this has been done, the officers of the industrial branch who have the program in charge discuss the entire matter with the industrial branches which have jurisdiction over the materials or the products out of which the article in question is made. Agreement is reached between the branches as to the amount of material which can be allocated, etc. . . . As an example, a program for the manufacturers of heating equipment would be initiated in the plumbing and heating branch of the division of civilian supply. It would be worked up in consultation with the industry, and cross-checked to see how the military requirements situation might affect it. Then, when it had been put in shape, it would be referred to the various raw materials groups—the iron and steel branch, the copper branch, etc.—for a final checking. When the program drawn up along these lines has been agreed upon by the branches involved, it will be presented to the executive director of SPAB, in order that it may be properly synchronized with other programs. It is then presented to SPAB. After SPAB has passed on a program—either approving it, modifying it or taking such other action as seems advisable—the program is referred to the OPM priorities division, which undertakes to make it effective and, where possible, to make sure that the needed quantities of goods will in fact be available, through the issuance of the required priorities ratings or through allocation of materials.

Quoted . . .

"The way to prove that free enterprise works is to go out and exercise some free enterprise when you get into a tough spot. The way to demonstrate the value of free competition is to go out and do some free competing when the going gets bad. There are of course some spots where all the enterprise and competition on earth won't solve the problem—but the manufacturer who dares to assume that he is in such a spot until he has gone out and done every imaginable thing he can do to solve his own troubles is simply asking his country to conclude that this free system is out of date. The manufacturer who can think of nothing better to do than to hurry up and dump himself in the government's lap is destroying free enterprise." — DONALD M. NELSON, executive director, Supply Priorities and Allocations Board, in an address November 13.

In order that current operations may dovetail properly into the whole broad project, OPM's administrative order devised a new routing system for the handling of PD-1 preference rating applications, effective December 1.

CENTRAL HEATING—The power and communications branch, Office of Production Management, released information November 4 to guide applicants for project preference ratings in the electric, gas, water, sanitation, central heating and telephone and telegraph fields. Instructions to applicants call for complete details of proposed construction and proof of need of the project. The application should be a sworn statement by an executive officer of the applicant. All applications must be submitted in the name of the operating company. The applicant in cases of specific necessity may ask at a later date for preference ratings on individual elements of the project higher than that assigned to the project, submitting such requests on form PD-1. Applications are to be addressed to J. A. Krug, chief, power branch, Office of Production Management, Social Security Building, Washington, D. C.

COPPER—The restriction against the use of copper sheet, strip and screen in building construction was eased November 1 by the division of priorities of the OPM. Due to go into effect November 1, the restriction would have "frozen" stocks of already fabricated materials in the hands of manufacturers, distributors and consumers. Because of this, the restriction was revoked and copper sheet, strip and screening may be manufactured at a reduced rate and used until January 1, 1942, after which their manufacture is prohibited under the general terms of copper conservation order M-9-c. A number of changes, largely for clarification, were made in the order by a series of amendments. The prohibition on use of copper in air conditioning equipment was amended as follows: "except for essential food storage and transportation and industrial processing where the use of other material is impractical." "Screening and screens" was changed to "insect screens and screening." Under the heading of plumbing and heating supplies, the phrase "convectors and local heaters" was changed to read "convectors, local and unit heaters (except heat controls)." Unions, except seats and valves over 2 in. size, and seats, discs and stems also were added to the prohibited list.

DEFENSE HOUSING—Amendments to the defense housing critical list and to interpretation No. 1 of this list, announced November 13 by the priorities division of the OPM, restore to good standing the use of oil burners in defense housing construction on the eastern seaboard. At the time the original critical list was issued, the acquisition of oil burners for defense housing units in certain eastern states was not assigned the priority assistance applicable to other building materials. . . . A revised list of defense housing critical areas, announced at the same time as the amendments, includes three additional areas: Sacramento, Calif.; Marion-Carbondale (Crab Orchard Lake), Ill.; and Bonham, Texas. . . . It has been found desirable further to encourage construction for rent, rather than for sale, and this has been done by assigning higher preference ratings than

New "mass production" Flying Fortress — A striking flight photograph of the new four engine Boeing B-17E, key weapon for defense

formerly to houses which will be rented by defense workers, since rental is better suited than purchase to their needs.

IRON AND STEEL—The priorities division of the Office of Production Management issued October 31 a repair and maintenance order for the iron and steel industry, which will make it possible to keep in operation the equipment, including the older and less efficient units pressed into service for the emergency, which is necessary to maintain the high production levels of the past months.

The order provides a basic preference rating of A-3 for essential repair, maintenance and operating material. For material necessary to repair actual breakdowns, an emergency rating of A-1-a will be assigned. Advance purchases of material to avert breakdowns and suspensions will be facilitated by the assignment of an A-1-c rating. The high breakdown ratings, however, may be applied only with the express permission, secured in advance, of the director of priorities.

Plants to which this assistance is extended include those engaged in the production of pig iron, primary forms of steel, blast furnace coke, and ferroalloys. Producers must file with OPM's iron and steel branch an acceptance of the order, and a statement of past inventories and consumption, on form PD-148, before applying the basic preference rating assigned by the order. Once authority to do so has been granted, and a serial number assigned, no further application need be made for use of the A-3 rating. A producer, or a supplier, must endorse on his purchase orders a statement to the effect that the rating is being applied under the terms of preference rating order P-68, and must file periodic reports with OPM.

Ratings may be applied by a producer to repair, maintenance and operating items, and by a supplier of material directly required by a producer for these purposes, or to material which is to be physically incorporated in other material to be used by his customer in the same way.

PIPE LINE—The Supply Priorities and Allocations Board ruled November 6 that priority ratings will not be issued for construction of the proposed national defense pipe line. On September 16 the board ruled against priorities for the steel plate out of which it was originally proposed to build the line. It left open, however, the question of permitting construction of the line if extruded pipe were used; and accordingly, a revised application was submitted by the petroleum coördinator calling for the use of seamless steel tubing in place of pipe made from plates.

In its November 6 action, however, SPAB held that the value of the pipe line as a defense project was not great enough to justify the high priority ratings that would be necessary. Since defense needs are so great, SPAB ruled, large quantities of critical materials must not be devoted to any project, even if the project is wholly desirable in itself, that is not essential either to the defense program or to the public health and safety.

SPAB recognized the vital importance of assuring the eastern seaboard region an adequate supply of oil, and requested the petroleum coördinator to explore the possibilities in other methods of getting oil to the seaboard. Among these it cited greater use of railroad tank cars, the possible construction of concrete oil barges, and the possibility that boats of the "sea otter" type could be used to carry oil. It also cited the savings in oil consumption which might be made through re-conversion to coal of certain eastern industrial plants, and restrictions on the use of gasoline for pleasure driving, in case it should not prove possible to bring in sufficient oil for essential purposes through these alternative methods.

In addition, SPAB pointed out that it may be advisable to build other, less expensive pipe lines which, covering shorter distances, would link sources of supply with markets in such a way as to ease the eastern oil supply at a comparatively minor expense in materials. The action is not to be taken as rejection of the idea of building any pipe lines at all, but is applied solely to this particular project, according to the SPAB.

Tube to build the pipe line would be available if high priority ratings were granted. The entire quantity needed to build the 1589 miles which the national defense pipe line would cover could be produced between November 15 of this year and September 1 of 1942. It would not be possible to get the necessary valves, pumps, motors and tanks built in time for installation as needed without interference with important defense items, it was stated.

LABORATORIES—In a move to broaden the assistance already extended to research laboratories, the OPM priorities division issued November 15 preference rating order P-62 assigning a preference rating of A-5 to acquisition of the scarce materials required by manufacturers of the necessary laboratory chemicals and equipment. The order was effective immediately. Producers who supply laboratories engaged in research, testing, analysis, and in plant control studies, as well as clinical and academic (college and high school) laboratories, are covered by the order. The rating is applicable to material required for packaging the equipment for delivery, as well as to those elements entering into its manufacture. A previous order, P-43, extended to certain accredited laboratories engaged in scientific research a preference rating of A-2, and is applicable to orders placed by them for essential materials. The new order, however, specifically aids producers of certain equipment which the laboratories require.

FIRE FIGHTING APPARATUS—Beginning October 31, manufacturers of essential fire fighting apparatus, needed to fill defense orders, have been assisted by a preference rating of A-2 in acquiring the necessary materials.

Are Radiators Necessary in Air Conditioned Buildings?

When the present air conditioning system was installed for 15 floors of our office building in 1937, the radiators were left under the windows. The intention was to use these radiators for heating the space in winter, using the air conditioning system for ventilating the space only, delivering the ventilating air at a fixed temperature.

After operating the system for a time, we found that the radiators under the windows were ample for heating the space in close proximity, but away from them, the room temperature dropped below comfort, in spite of the fact that the delivered air from the conditioning system was set at 72 F. Raising the temperature of the delivered air proved satisfactory only as long as there was no change in outdoor conditions. When outdoor conditions changed, the temperature of delivered air had to be changed. In a system using a large number of units, this continuous change would be impossible with manual control.

Our next move was to change the controls on the conditioning system so as to make these temperature changes automatic, according to the mean temperature of the room. In other words, the system was changed to a full indirect air blast heating and ventilating system, with the attendant controls, and the occupants of the various spaces were instructed not to turn on radiators.

This condition worked very satisfactorily until severe outdoor temperatures set in. When downdraft conditions on outside walls and windows exceeded 50 fpm, and temperatures in these localities fell to 68 to 70 F, we allowed the use of the radiators. This method of operation proved satisfactory. The downdraft was changed to updraft, temperatures increased to 78 to 80 F, and air movement was 50 fpm. But as soon as the severe outdoor conditions modified, the space around windows and outside walls remained at a comfortable temperature while the temperature of inner spaces dropped below comfort.

Our next change was to limit the heat emission from the radiators, so that at no time would the updraft exceed 25 fpm. This was done by reducing the steam pressure and employing other means. After these changes were made, we found that the updraft at windows and outside walls never exceeded 25 fpm whether the conditioning system was operating or shut down.

Using the conditioning system with full steam pressure in the radiators increased our steam consumption approximately 40 per cent. After the radiators had been restricted, our steam consumption was reduced 20 per cent from the original.

From the above described condition, it is apparent that the radiators are an absolute necessity.—W. C. Heimbeck, building manager, and M. Ehrlich, building engineer, Harvester Building.

Comment by Samuel R. Lewis—The statement above that radiators are an absolute necessity should be qualified, I think, to the extent that the statement applies to rooms which have windows, and to systems of heating in which the air delivery temperature to individual rooms is not varied automatically and simultaneously to meet the requirement of each separate room.

It should be qualified to some extent also by a limitation as to the method of air introduction. For example, despite hot water radiators individually controlled to give moderate surface temperatures in an air conditioned office building observed this fall, there is a noticeable downdraft near the windows in rooms having overhead air supply grilles directing the air horizontally toward the outside walls and the windows.

If the man in the office in this building sits with his back toward the glass and the radiator he is not comfortable. If, however, he sits with his side toward the outside wall or if the air supply grilles are in the ceiling or are not opposite the outside wall, there is no complaint of the reacting downdraft.

All of this seems to be argumentative toward use of low velocity diffusers, double windows and possibly toward panel type radiation.—Samuel R. Lewis, consulting engineer, and member of HPAC's board of consulting and contributing editors.

[*As noted on p. 680 of the November HPAC, the editors will welcome further comment from HPAC's readers on this problem.*]

"Open for Discussion"

Communications to the Editor

WHY PANEL HEATING? —AN EXPERIENCE REPORT

The Editor—

In his letter published in the September HPAC, J. R. Walker suggested that someone demonstrate whatever real advantages panel heating might have.

Our experience with panel heating is confined to three local installations employing ceiling panels exclusively. The first installation designed by us was made locally in 1938 and has been through three winters' operation. The second installation, made in our own test house in 1940, has been through one winter of operation. The third installation, in the home of one of our officers, made this year, has not completed a full year's operation.

The test house was built expressly for the purpose of developing data for application of the system. It is an eight room, unfurnished, unoccupied house—equipped with 175 thermocouples and instrumentation for recording essential data. The opinions expressed below are based primarily on observations made at this test house.

Uniformity of Temperature—A drastic reduction in the temperature variations that were accepted years ago has resulted from better heating systems and better construction. Nevertheless, the modern, intermittent, automatically controlled system of convection heating develops a variation between the end and beginning of the "on" period sufficient to have given birth to the term "cold 70."

With forced hot water heating the water is delivered to the radiators at approximately 190 F until the thermostat is satisfied, when water circulation ceases and the radiator or convector may cool almost to room temperature. With forced warm air the air is delivered through the grilles at about 145 F until the thermostat is satisfied, when air delivery ceases. These intermittent injections at relatively high temperatures cannot produce the uniform environment obtainable from a constant source of heat at temperatures controlled within a relatively close range. Even though panel heating may be intermittent in operation, the very nature of the system is such that wide temperature fluctuations in the heating panel are impossible.

In normal winter weather of + 24 F, the average ceiling panel temperature in the test house was 77.5 F. The low average panel temperature for any time reading during the 24 hours was 71.7 F at 2 p.m. after several hours of sun effect, and the high was 80.9 F at 6 p.m. after the loss of sun effect. This narrow range of 9.2 F in the heat source compares with possibly 120 F for convection systems. A heat source which blankets the entire room and is maintained within such narrow limits should definitely insure a more uniform environment.

Panel heating is a mass heating effect as compared with the concentrated heat source of conventional methods, the result of which on test reflected an average ambient temperature differential of the order of 0.7 F between the beginning and end of the "on" periods, which compares with 2 F or more for convection systems. Vertical gradients also show an improvement as indicated by the following average readings over a 24 hr period in 10 rooms: 68.8 F 6 in. above the floor, 70.5 F 5 ft above the floor, and 71.8 F 6 in. below the ceiling.

Constancy of Temperature — Throughout a panel heated room there is also a constancy of temperature apparently not obtainable with convection heating. As the heat loss of the structure increases with colder weather, the inner surface temperature of exposed walls is depressed, radiation losses from the body to these cooler surfaces increase, demanding higher air temperatures for comfort. This air temperature gradient with conventional heating systems may easily reach a magnitude of 8 F, which must be manually regulated by thermostat adjustment.

As panel heating is the reverse of convection heating in that the air is warmed from the walls, the mean radiant temperature cannot drop below the air temperature. Air in a panel heated room closely approximates the MRT and finds a comfort level at about 70 F. This 70 F mean radiant and air temperature level is maintained within rather close limits regardless of outdoor temperature.

An average of seven points in exterior walls of the test house at 2 a.m. (no sun effect) was 65.9 F with an outdoor temperature of + 14 F. At 11 a.m. (bright clear day) the same seven points averaged 70.8 F, the outdoor temperature having risen to + 31 F. An average of the seven points over a 24 hr period with an outdoor temperature of 24.7 F was 67.2 F. When the low exterior wall temperature was recorded at 2 a.m., the average floor temperature was 70.5 F and the ceiling 78.5 F. At 11 a.m., when the exterior walls rose to 70.8 F, the floor dropped to 68.9 F and the ceiling to 75.2 F. These two sets of conditions produced almost identical mean radiant temperatures and therefore no adjustment in the air temperature was necessary to maintain comfort.

Greater Comfort from Warm Floors—A stratum of cool air over a floor which is even cooler is not conducive to comfort. With panel heating, the floor is warmer than the air immediately above it as indicated by the following average readings: floor, 70.6 F; 6 in. above floor, 68.8 F; 5 ft above floor, 70.5 F; 6 in. below ceiling, 71.8 F; ceiling (the heating panel) 77.5 F; outdoor temperature, 24.7 F.

Cleanliness and Appearance—In addition to these "comfort" advantages, panel heating should contribute to cleanliness. There is no part of the system wherein dust can collect. Convection currents established by the heating system are extremely slight and therefore do not disturb dust that may be present. There is no discoloration of walls or ceilings which so frequently accompanies convection systems and no part of the panel heating system need mar the beauty of the living quarters or interfere with furniture placement or decorations.—H. F. Randolph, vice-president, International Heater Co.

LIKES PANEL HEATING

The Editor—

I can't help expressing an enthusiastic "pro" for F. W. Hutchinson's article, Why Panel Heating, in the October issue. I feel that I can speak with some authority of experience, having lived with the system through a fairly severe winter in our new office building in Greenville, S. C.

To describe our installation briefly, wrought iron grid coils were laid on a broken stone fill on the ground floor level, and a concrete floor slab poured over. On the second floor level wrought iron coils were set on a 2 in. layer of cork under the concrete floor. Water heated by a standard boiler is circulated through the system at a maximum of 130 deg to maintain the proper floor temperature. [See HPAC, June, 1941, pp. 352-353.]

Reactions of the employees working in the building last winter seem to bear out the arguments presented by Professor Hutchinson. There were considerably fewer colds and one woman announced absolute freedom from sinus trouble which had bothered her considerably in the past. Men working at the drafting tables noticed less fatigue and there was a complete absence of the sluggishness which ordinary heating systems sometimes seem to cause when they are working at full intensity during cold weather.

It is impossible for me to surmise whether these reactions were caused by lower air temperatures, lack of drafts, proper humidity, or ion balance, as Professor Hutchinson's article suggests. I can, however, offer them as an example of one installation which has borne out all the claims made for the radiant or "panel" type of heating.—Dan H. Wallace, Jr., president, Greenville Steel and Foundry Co.

ADDITIONAL RESEARCH ON PANEL HEATING NEEDED

The Editor—

The recent comments on this page regarding panel heating have been interesting and instructive. Professor F. W. Hutchinson's article in October ably sets forth the advantages of the method as recognized in England.

There seem to be one or two points that should be clarified. One of these concerns definitions and terminology. There is a tendency to refer to panel heating and radiant heating as being synonymous; actually they are not entirely so. A panel heater, being a flat surface, emits a larger part of its heat by radiation than if the same surface were crumpled up into the form of a conventional radiator or convector, in which much of the surface is shielded from view. But a panel heater does not ordinarily heat *entirely* by radiation; in fact, it would be difficult to design a system of purely radiant heating because the temperature of the room air eventually tends to rise, as the floors, walls

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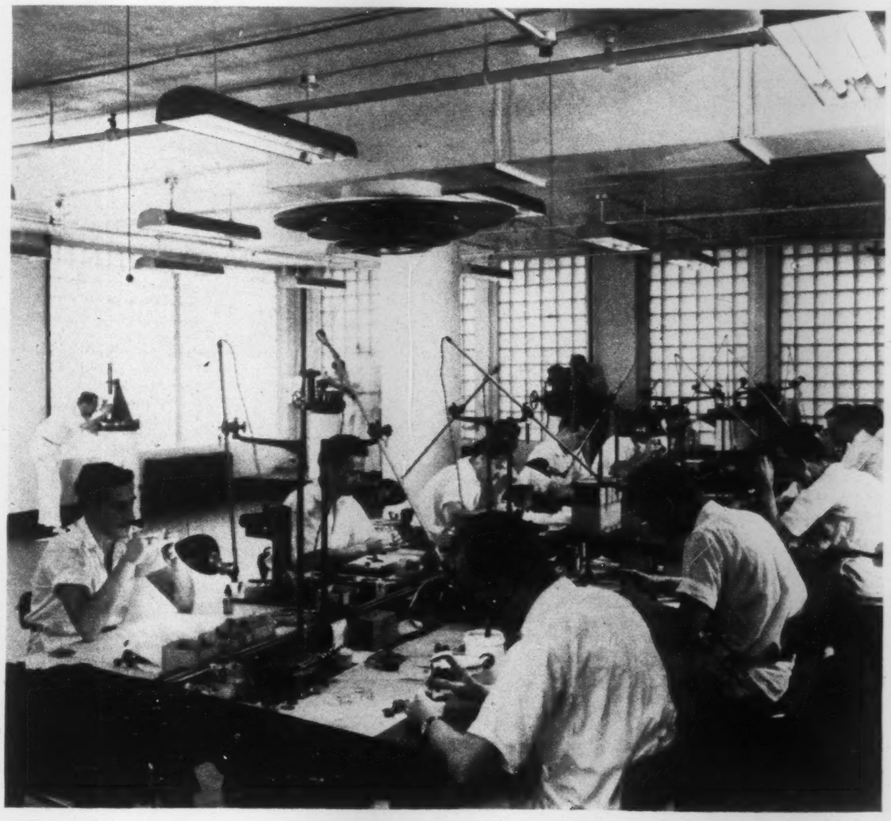
AIR CONDITIONING FOR DEFENSE

High precision work is done in this air conditioned, humidity controlled, dustproof workroom at the Mergenthaler Linotype Co., "Linotype headquarters." It is necessary to control temperature and humidity in the room so that atmospheric variations will not affect delicately adjusted instruments being made for national defense. Several parts of these instruments have to be sealed in under conditions which are just right in order to guarantee their accuracy



and furniture become warmed. The nearest approach to pure radiant heating is to place the heaters overhead and thus minimize the convection effect.

A second point of confusion is in regard to the benefits of a lower air temperature. Naturally the more radiant heat the lower will be the effective temperature necessary for an equivalent feeling of warmth. However, heat loss from the clothed human body takes place first to the air space inside of the clothing. It is doubtful that radiant heat, of the amounts and wave lengths which we are considering, penetrates the clothing appreciably. Therefore, as to most of the body surface the body probably "doesn't know" whether it is in an environment of lower temperature and more radiant heat or of higher temperature and less radiant heat.

T. Napier Adlam's comment in November regarding the effect of radiant heating upon metabolism does not appear to me to be well-grounded. Mr. Adlam states that metabolism rises with decreasing temperature and that such increase in metabolic rate is beneficial. Is it not assumed that with radiant heating the overall feeling of warmth will be unchanged, and if so how can we assume an increase in metabolic rate? Furthermore, Winslow and his associates have reported[1] that they found no appreciable change in metabolic rate over a considerable range of temperature.

H. F. Randolph presents above some interesting factual information. He scores some telling points when he shows the low temperature of the heating surfaces and by his statement that "A heat source which blankets the entire room and is maintained within such narrow limits [of temperature] should definitely insure more uniform environment."

Methinks, however, that he oversells panel heating when he compares it with forced hot water using a temperature of 190 F and forced warm air using a temperature of 145 F. A forced hot water system is not necessarily designed for 190 F. Such a temperature is no more fundamental in a hot water system than it is in a panel system. The use of larger radiators reduces the temperature necessary in extreme weather; and in any case intelligent operation calls for temperatures which are graduated in accordance with the outside temperature. Panel heating should be compared with the best practice in other fields, not with the worst.

No one will deny that there are certain advantages in panel heating. To avoid cold floors in a building having no basement, to counteract the negative radiant effect of large expanses of windows, and for other special purposes, panel heating is undoubtedly advantageous. From the physiological standpoint there may be distinct advantages, but they certainly require much further study before they can be stated as established facts.

The danger is that the panel method will be exploited and oversold upon the basis of half-baked or wholly fictitious talking points which the public has no means of verifying or disproving.

What is needed right at this time is additional research in laboratories and some critical examinations of the performance of existing installations so that the advantages and limitations can be clearly understood and made known.—J. H. Walker, superintendent of central heating, The Detroit Edison Co.

CAN CEILING OUTLETS KAYO CEILING SMUDGE?

The Editor—

We believe the article on ceiling smudge with ceiling air outlets by F. W. Wills and G. F. Nightingale, published in the November HPAC, contains some very good comments and practical suggestions for overcoming the trouble in question. However, it is our thought that the filtering equipment on any air conditioning job should be as nearly perfect as it is possible to make it, as cleaning of the air is one of the important functions on which the air conditioning system is originally sold and this should be apart from any consideration as to whether the air outlets do or do not cause smudging.

Undoubtedly, a great part of the trouble is because many architects prefer to use ceiling outlets or diffusers that are flush with the ceiling surface. This appears to be in keeping with present day artistic demands for interior decoration. We believe there should be some compromise between these artistic demands and the engineer's demands to provide air diffusion without discoloration of adjacent wall and ceiling surfaces. This could be accomplished by using outlets situated beneath the ceiling surface with fixed or adjustable vanes to positively deflect the air stream at a safe angle away from the ceiling surface. The degree of this angle would, necessarily, be determined by the velocity of the primary air stream at the diffuser. It is commonly accepted that induction increases with velocity, and as induction is one of the main factors which introduces dirt particles into the primary air stream, the downward angle of the primary air current should be increased as the velocity and induction is increased.

We believe that closer coöperation between engineers and architects in this respect would considerably help to overcome this annoying problem. —John C. Knox, secretary-treasurer, Waterloo Register Co.

MOST TIMELY ARTICLE

The Editor—

The article on ceiling smudge in the November HPAC, by F. W. Wills and G. F. Nightingale, will, I am sure, be read and discussed by many who are interested in ventilation and air conditioning. It is most timely.

Smudging of wall surfaces is not confined to ceiling diffusers, however; grilles often are surrounded by unsightly streaks, as many know to their sorrow.

Good air filters properly installed and sealed against bypassing and properly maintained, will reduce the smudge patterns on walls and ceilings. Many of us have been engaged in an effort to impress these matters on designing engineers and operating engineers and the results are encouraging. The conclusions of the authors seem too hastily drawn, however, much as I would like to agree with the thought that perfectly clean air discharged from a diffuser will leave no ceiling pattern.

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[1] Physiological Reactions and Sensations of Pleasantness Under Varying Atmospheric Conditions, ASHVE Journal Section, Heating, Piping and Air Conditioning, January, 1938. See also the Heating, Ventilating, Air Conditioning Guide 1941, p. 43.

An experience of mine a couple of years ago may be of interest in this regard:

The all-electric kitchen of a modern restaurant is the pride of the owner. The ceiling is furred down with ducts concealed behind acoustical tiling. Ceiling height is about 10 ft. The kitchen is in the basement of a building formerly used for another purpose.

Ceiling diffusers are used (although not of present design) to distribute the conditioned air. All outlets are supplied from a single fan and a bank of modern, efficient air filters, the system being designed and erection supervised by a capable and experienced engineer. Over the electric ranges are large banks of range hood or grease filters, which incidentally are cleaned weekly and which have elicited most favorable comments from local fire officials.

Soon after operations started I was called to go down and explain why the ceiling around some of the outlets was showing dirty circles or rings. The manager intimated that the filters were at fault, but he seemed more puzzled than angry.

Well, they showed me nice dirt patterns, like doughnuts, about the ceiling diffusers, very distinct indeed, and was my face red! As I walked around, accompanied by the manager and his men, I became aware that only *some* of the outlets showed dirt patterns, and stranger still, these patterns were of *three different colors.* Then it dawned on me that since all outlets were fed from a single filter bank all outlets should show rings, and they should be of the same color and of about the same density.

I was soon up on a stool feeling the dust rings, and the answer was obvious. The dark gray rings were around the outlets near the ranges and the dirt was greasy. There was a fine white ring of flour dust around the diffusers immediately over the tables where pastry and breads were prepared. Over an electric potato peeler was a nice brownish ring of clay or earth.

In other words, under each diffuser which showed rings of smudge was the obvious source of the dirt, easily identified. Most of the diffusers in this kitchen showed no ceiling discoloration; only those over dust-producing processes were dirty.

The manager explained that he too had reached this same conclusion but he just wanted to see what I had to say—and he and the owner, who operates a most successful chain of restaurants, have remained my valued friends.

The moral of all this is evident. Room dust does at least contribute to diffuser smudge on ceilings. It might be interesting to explore this matter in a laboratory set up, by discharging dust free air (from an electric precipitator) through a diffuser and liberating in the room a fine dust of a distinctive color. My guess is that a color ring will appear on the ceiling if the air from the diffuser passes out nearly parallel with the ceiling.—F. F. ESPENSCHIED, district representative, American Air Filter Co.

SOLAR HEAT THROUGH GLASS

THE EDITOR—

How does solar heat gain through frosted and plain glass compare? In the September HPAC, Dr. F. C. Houghten says it will not differ materially. Well, I bet I can produce experts to disagree! In fact, I don't agree myself, and here's why:

Anything in the path of the sun light ray will absorb some radiant heat. The fact that clear glass absorbs about 10 per cent in one layer and about 18 per cent in two layers is partial proof. If you paint glass with green translucent paint, it absorbs more heat than if you whitewash. The error in Dr. Houghten's reasoning comes from his acceptance that "frosted glass is assumed not to reduce the visible light, etc."

Any illuminating engineer knows that frosted glass absorbs light. This is true, whether it be a frosted lamp bulb or a pane of frosted glass over a fixture—fluorescent tubes for example. Frosting also tends to increase the dirt pick-up, hence inside frosting for lamp bulbs.

The heat absorbing glass also absorbs light. So does glass block and so does plain dirt on any kind of glass.

The answer to the question is therefore that the frosted glass absorbs more of the radiant heat than clear glass, and how much more depends upon how the frosting is accomplished. But the joker is that this absorbed radiant heat is converted into sensible heat, actually raising the frosted glass temperature. It in turn becomes a secondary panel heater and probably half of the *absorbed* radiant heat is returned to the outside and half goes inside, if inside and outside temperatures are equal.

As Dr. Houghten says, we have no data on frosted glass. I would *suspect* that it would absorb about 25 per cent of the radiant energy of the sun as compared with 10 per cent for clear glass, 18 per cent for double layer clear glass. Anything that gets in the way is going to absorb some heat and some light. Frosted glass is very definitely a better absorber than clear glass.—LESTER T. AVERY, Avery Engineering Co.

Readers of HEATING, PIPING AND AIR CONDITIONING are invited to contribute their views to these "Open for Discussion" pages, which will appear from time to time. Comments on articles we have published, expressions of timely interest on developments in design, installation, operation or maintenance of heating, piping or air conditioning systems, other remarks of value to HPAC's readers—all will be welcomed by . . . . THE EDITOR.

BALCONIES DESIGNED TO CUT COOLING LOAD

The balconies on the westerly wall of the Longfellow building are primarily to reduce sun heat gain through the windows. They add to architectural interest, emphasize the building's important facade

1201 CONNECTICUT AVENUE

William Lescaze, architect

The new Longfellow building in Washington, D. C., illustrates a principle of construction designed to reduce air conditioning costs—balconies to cut the sun heat load.

The building has air conditioning on each office floor from the second to the 12th. Each floor is provided with a separate, independent unit consisting of water coils, winter humidifying sprays, filters, etc. Air from the coils goes to three zones on each floor; these zones have south, west and north exposures, respectively, and each can be supplied with a different temperature air to offset the effects of solar radiation during different times of the day. Cooling is supplied for the air conditioning by a 195 ton centrifugal refrigeration machine.

The building has continuous windows in the working areas to improve the usefulness of the interior space by permitting greater flexibility of furniture arrangement and by eliminating the shadow producing wall areas which occur between windows in the usual method of fenestration. The relatively large window area results in a great increase of the cooling load on the air conditioning system, due to the transmission of the sun heat falling on the glass being transmitted to the interior of the building. The effect of sunlight falling on glass areas is particularly bad as practically all of the sun heat is immediately transmitted to the interior of the building. Sunlight falling on walls has not this immediate effect as it is not transmitted directly but serves to heat the wall itself which gives up its heat gradually over a period of several hours.

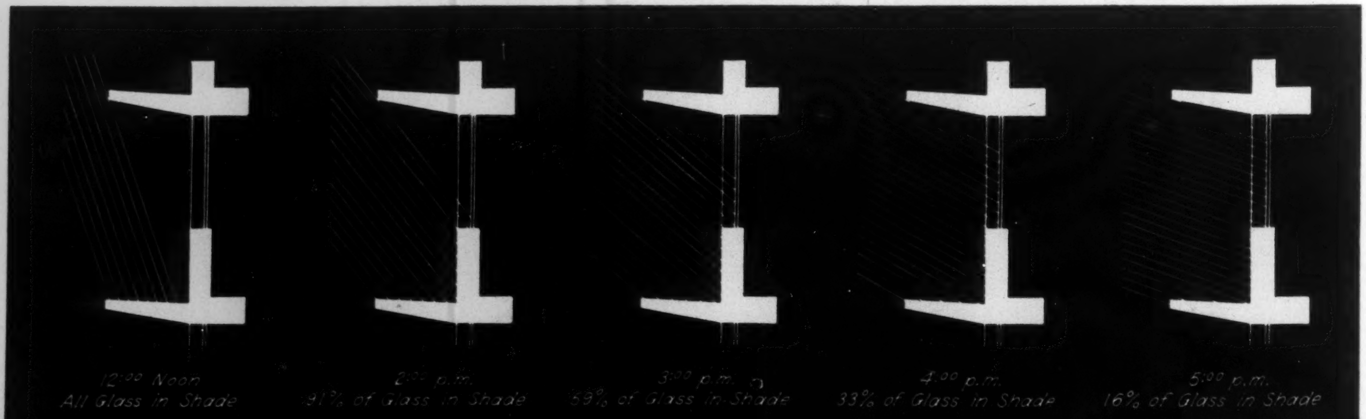
As the location of the Longfellow building necessitated the use of the westerly wall for day lighting the office space and precluded the possibility of any considerable reductions of the window area, shading of these windows in some way was necessary to mitigate the undesirable effect of the sun.

It was decided that a permanent projection or balcony would be rigid and fireproof and would always maintain a good and clean appearance. The projections or balconies are 4 ft wide. The actual effect of these projections is indicated in the sketches which show the directions of the sun rays for various hours of the afternoon of August 1st. The Connecticut avenue wall of the Longfellow building faces approximately 23 degrees south of west.

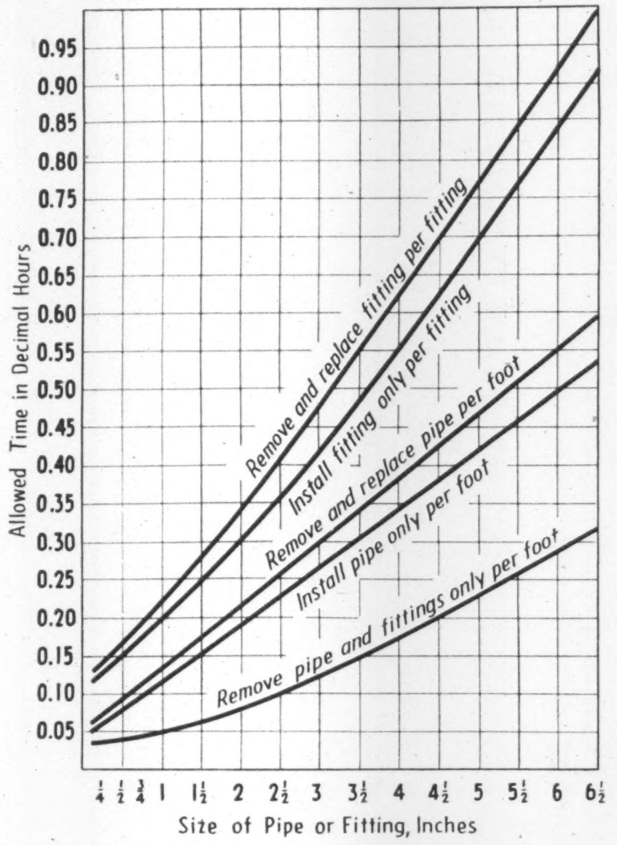
The total saving in cooling load resulting from the projections was estimated to be 24 tons of refrigeration.

The architect was William Lescaze; mechanical engineer, Leslie J. Hart; contractor for heating and cooling, Adams Engineering Co.; general contractor, John McShain, Inc.; structural engineer, Fred N. Severud.

These sketches indicate the effect of the balconies in reducing the sun heat load on the westerly wall of the building. This wall faces 23 degrees south of west



Sunlight on Connecticut Avenue Windows – August 1st



The type of chart used, showing allowed time plotted against the size of pipe or fitting. This one gives time allowances for installing, removing or replacing overhead piping

Time Study of PIPE FITTING Leads to INCENTIVE PLAN

Pipe fitter welding 8 in. water main to provide clearance for new crane runway

IN ORDER that management may more closely control its pipe fitting costs and the men receive just compensation for their work, a measurement system has been devised at the East Pittsburgh works of Westinghouse whereby the complex variable time values for pipe fitting can be compiled in chart and curve form for simple computation and application. It has been noted that under this new system there has been a decided decrease in supervision cost and the men have been able to increase their earnings through improved performance.

Extensive time studies were taken covering all phases of the work, and where possible standard methods for performing work were formulated. The three kinds of pipe handled—standard, hydraulic and cast iron—had a decided effect upon the cutting, welding and threading time due to the various thicknesses and a slight influence on the handling time due to the variances in weight. Other time studies were compiled for such variable factors as the diameter and length of pipe; the type of fitting; the location, whether in a ditch or under the floor, at floor level, or overhead; type, size, and gage of the bends; outdoor weather conditions; and amount of removal of old piping.

To all time computed from the charts is added the set-up time for collecting tools, equipment and material and moving to the job as well as the time required on the part of the group leader for supervision and time keeping.

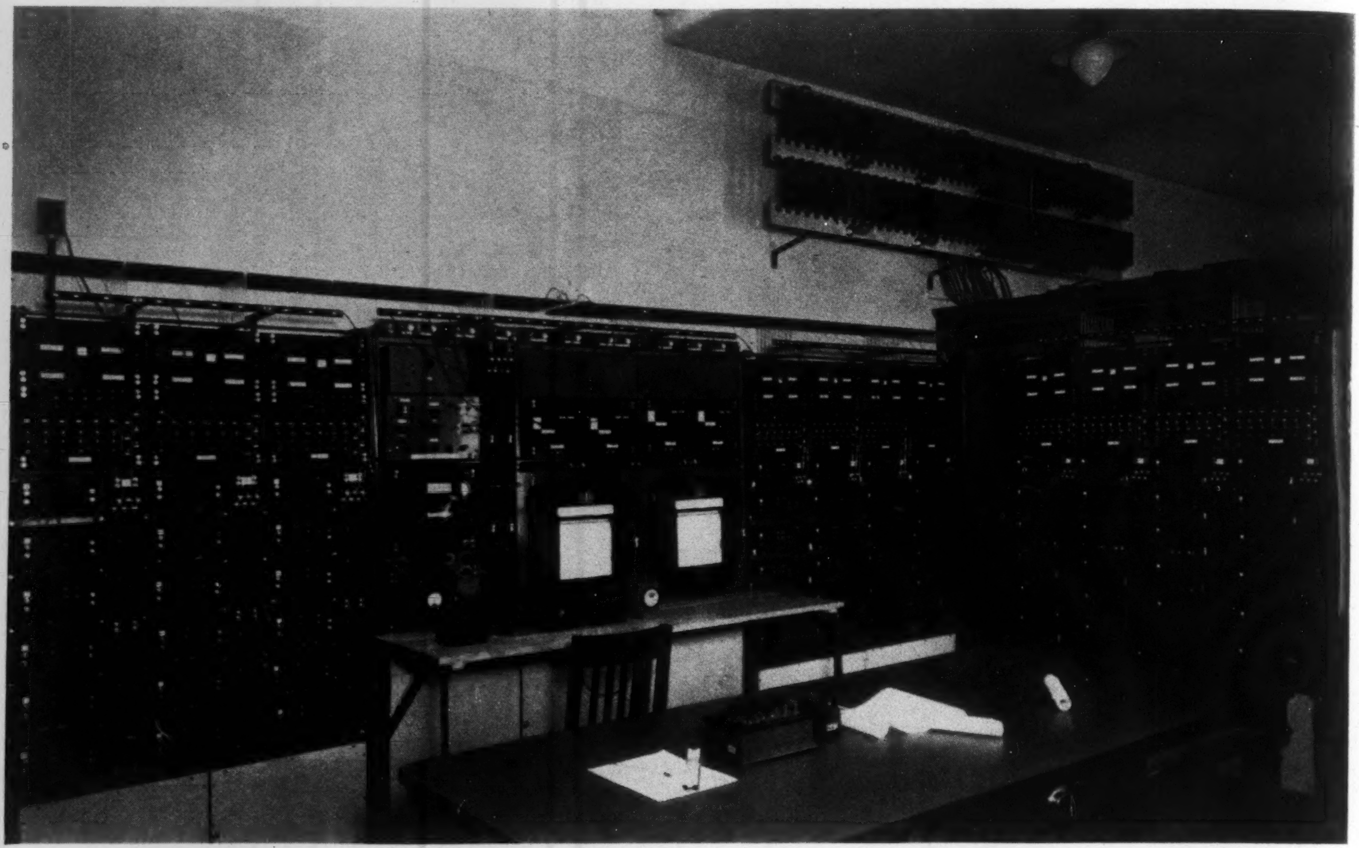


Photo courtesy Power

Fig. 1—This complicated appearing electrical equipment is used to simplify the solution of numerous transient heat flow problems

HEAT FLOW PROBLEMS SOLVED BY ELECTRICAL CIRCUITS

Victor Paschkis Describes Ingenious Application of Electrical Analogy for Solving Heat Flow Problems

HEAT FLOW problems of a transient or intermittent character are highly complicated and most difficult to solve by mathematical analysis or experiment. Such unsteady state problems—many of which are of great importance in heating and air conditioning—are simplified by analogy with electrical circuits. For instance, a building wall can be thought of as made up of a number of sections, and electrical resistors and condensers can be hooked up to represent thermal resistances and thermal capacities. By choosing the size of the electrical apparatus appropriately, the time cycle can be changed so that a 24 hr period may be represented by the same number of minutes, or less. . . . Dr. Paschkis, research associate in the department of mechanical engineering at Columbia University, describes the new method here

IT HAS been the custom to handle transient heat flow phenomena as if they were steady state problems. In recent years, however, the number of problems in the field of heating, cooling and air conditioning which are recognized to be of the unsteady or transient type is rapidly increasing. The solution of such unsteady state problems can be sought either by mathematical analysis or by experiment. Both methods offer a large number of difficulties.

In view of these difficulties, a new procedure which can be used for the solution of many heretofore unsolved unsteady state heat flow problems is of interest. It is based on the analogy between heat flow in solids and the flow of electricity in certain types of electrical circuits (resistance capacity circuits). The method has been described in detail in a previous paper (Reference 1). A review of the method, avoiding mathematical and electrical deductions, has been published by P. W. Swain (Reference 2).

In order to investigate a heat flow problem, an electric circuit is set up; electric voltage is applied and the current and voltage at various points in the circuit are measured. From the electrical data thus obtained the desired values of temperature and heat flow can be calculated. The heat capacity (specific heat × density × volume) of the body subjected to the heat flow is represented by an electric capacity (condenser), and the thermal conductance by an electrical conductance (or the thermal resistance by electrical resistors); the voltage (difference of electric potential) represents the difference of temperature, and the electric current represents the heat flow. It should be understood that there is not only a general analogy between the electric (model) circuit and the heat flow problem, but that exact numerical results are obtained by the transforming calculations.

Actual work by this method is greatly facilitated by convenient arrangement of the condensers and resistors, which should allow a rapid setting up of any desired combination of resistance and capacity values. Such a laboratory (Fig. 1) has been built in the school of engineering at Columbia University containing 15 identical groups or sections of resistors and condensers and a central instrument panel. The operation of the method will be more clearly understood from the description of a practical example.

It has been pointed out (Reference 3) that it is not sufficient to determine the overall (steady state) conductance of a wall construction; for a proper determination of the size of the heating and cooling plant the periodic heat flow has to be considered. The daily and seasonal oscillations of the temperature, wind direction and wind velocity create a periodic heat flow in the wall, which has been investigated under certain conditions (Reference 4). The new model method will be explained here:

Given a wall as indicated by Fig. 2. In order to carry out any of the investigations mentioned here, the wall has to be represented in the model. In order to do this, the wall is thought cut into a number of sections (say six) as indicated by dotted lines in Fig. 2. Each section is then represented in the model by an electrical condenser applied in the center of a resistor, as shown in the wiring diagram of Fig. 3. The boundary resistances, both on the outside and the inside surfaces, are represented by additional resistors, which may be varied during the experiment in order to represent a change in the thermal boundary conditions.

By choosing the size of the condensers and the resistors appropriately, the time ratio may be changed. For example, the electrical units can be so selected that the daily cycle of 24 hr is represented in the model experiments by a cycle of 6 or 12 or 24 min. Which of these (or similar) values is actually selected will depend upon the number of adjustments in the settings of the resistors and condensers. A large number of changes (due to rapid and wide fluctuations of weather conditions) calls for a relatively long experimental time, giving the operator ample time to carry out the various settings of the electrical equipment. If the changes are slow and small, a shorter experimental time will be possible.

Once the model is set up for a given wall construction a number of experiments can be carried out, some of which are:

a) Flow of heat from the inside surface for a given room temperature at various cycles of weather conditions (sun radiation, temperature and velocity of wind).

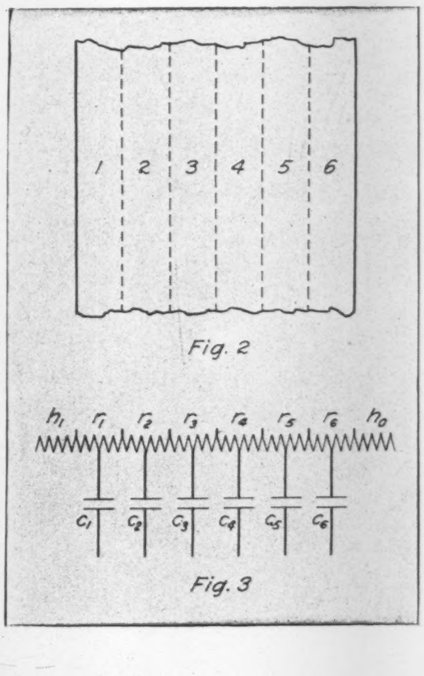
b) Flow of heat from the inside surface for a desired non-constant inside (room) temperature for various types of cycles of weather conditions.

c) Influence of discontinuities in the weather conditions: sudden temperature rise or drop.

d) Room temperatures with a given amount of heat generated (heating period) or carried off (summer cooling) by the heating or cooling system for a given weather cycle.

In mines and air raid shelters transient heat flow phenomena occur with intermittent occupancy. Take, for instance, an air raid shelter. The heat produced by the occupants will cause a temperature rise. For the "virgin" state of the shelter this rise can be computed. The shelter may be emptied after the "all clear" signal is given. The temperature will drop gradually. If the shelter should be occupied again, before it has cooled down entirely, then the temperature rise during the second period of occupancy will be different from that during the first period.

Fig. 2—Section through a building wall. . . . Fig. 3—Wiring diagram for electrical circuit representing the wall of Fig. 2; r_1 to r_6 represent the resistors and c_1 to c_6 the condensers for the elements 1 to 6 of the wall, and h_i and h_0 represent the inner and outer film conductances



The various temperature-time curves for consecutive periods can readily be measured on the model.

The selection of pipe insulation (material and thickness) should be based on the type of service (continuous or intermittent) and if intermittent, what frequency, etc. The information necessary for intermittent service (the total heat loss as function of the intermittency) can be obtained by the model method.

Pipes carrying steam or hot liquids are some times embedded in the ground. Their heat losses then are a function of the soil temperature, which is subject to seasonal changes. The heat loss as function of the soil temperature can be determined by the model method. Or if a "cold" tube should be in the vicinity of a "hot" tube, and either or both of them intermittently operated, the mutual effect can be evaluated.

References

1) V. Paschkis and H. D. Baker: A Method for Determining Unsteady State Heat Transfer by Means of an Electrical Analogy. Paper contributed by the heat transfer division for presentation at the national meeting of the applied mechanics division of the ASME, Philadelphia, June 20-21, 1941.

2) P. W. Swain: Electrical Machine Solves Heat Transfer Problems, Power, July, 1941.

3) F. C. Houghten, J. L. Blackshaw and E. M. Pugh: Heat Transmission as Influenced by Heat Capacity and Solar Radiation, ASHVE Journal Section, HEATING, PIPING AND AIR CONDITIONING, April, 1932.

4) J. S. Alford, J. E. Ryan, F. O. Urban: Effect of Heat Storage and Variation in Outdoor Temperature and Solar Intensity on Heat Transfer Through Walls, ASHVE Journal Section, HEATING, PIPING AND AIR CONDITIONING, July, 1939.

SPECIFICATION SHORT-CUTS

STREAMLINED SPECS—With the blanket protection of the covering clause in the "streamlined" form of specification devised by Horace W. Peaslee, Washington architect, one has merely to make a check list of material wanted and methods to be followed—and there you are! It is no longer necessary to watch for the hogtight requirement, with every sentence drafted like a last will and testament. . . . . A sample, as used by the Veterans Administration, is given here

A GROUP of the top specification men in government agencies is projecting radical simplifications in specification writing. This work is an outgrowth of the "streamlined" specification system devised by Horace W. Peaslee, Washington architect, publicized in the August, 1939, Pencil Points magazine and again in the November, 1939, Constructor.

In its essence, the system concentrates, in a single control clause, all the usual mandatory contractor-must and contractor-shall clauses which have made the specification a most complicated legal-technical document. In the new approach, materials, methods and operations are merely tabulated as headings and subheadings following a single control clause. This method eliminates the necessity of contract-tight sentences — in fact, all sentence structure—together with countless verbs, adjectives, conjunctions, etc., according to Mr. Peaslee. As originally projected, and as adopted by the Veterans Administration, the governing clause was as follows:

> The listing herein of article or material, operation or method, requires that the contractor shall provide each item listed—of quality, or subject to qualification, noted; and that the contractor shall perform each operation prescribed—according to conditions stated, providing therefor all necessary labor, equipment and incidentals.

This form, and the system as published, have been protected by copyright from commercial exploitation but made available, without cost, to government agencies and to the building industry. In its final form, the exact phrasing will probably be slightly different, says Mr. Peaslee.

The system has been in successful operation in the construction service of the Veterans Administration since March, 1940. Following are typical excerpts from a Veterans Administration heating equipment specification showing the use of the tabulated form from which the usual sentence structure, with its reiteration of "The contractor shall furnish, etc." is conspicuously lacking. It will be noted that the mandatory provision above occurs at the beginning of the section as part of the usual scope-of-the-work section:

1. *SCOPE OF WORK:*

The contractor shall furnish all labor and materials and perform all work required for installation of complete heating equipment required by drawings or specified herein.

The listing herein of article or material, operation or method, requires that the contractor shall provide each item listed, or quality, or subject to qualification, noted; and the contractor shall perform each operation prescribed, according to conditions stated, providing therefor all necessary labor, equipment and incidentals.

20. *CLEANING AND PAINTING:*

Clean piping, fittings, traps, exposed radiators, and iron and steel work.

Composition and application of paint to be in conformity with all applicable requirements of Section 31C, "Painting

Steam Piping, Valves, Fittings, Etc.

One coat of red lead and oil paint before erection or before covering is applied.

Vacuum Return Piping (Exposed):

Treated if necessary, and painted with one coat of lead and oil paint of color selected by Superintendent.

Iron and Steel Work, Traps, Hange Supports, Etc.

Two coats of lead and oil paint selected by Superintendent.

Exposed Radiators:

One coat enamel primer either at factory or at Facility and two coats Veterans Administration Standard No. 2 radiator enamel; radiators either hand painted or sprayed.

Convector Enclosures:

One coat enamel primer at factory.

Pipe Covering (Except Concealed):

One sizing coat of shellac, or approved equal sizing, and two coats of lead and oil paint, bands removed when painting.

Pipe covering in pipe basements, pipe spaces, etc., painted color selected by Superintendent.

Grille Fronts on Convector Enclosures:

One coat enamel primer at factory and two coats of best grade radiator enamel of color to match finish of rooms as selected by Superintendent.

Stencil Marks:

To indicate service, not more than ten feet apart, on all pipe lines.

21. *TESTING OF HEATING SYSTEMS:*

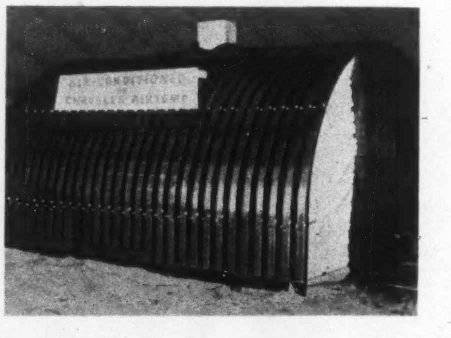
Hydrostatic test of 50 pounds per square inch on concealed piping.

After completion of heating systems, except application of *non-conducting covering in basements, pipe basements, and pipe spaces,* run 8 hour tests.

Purpose of Tests:

To determine and remedy the following: Leaks, slow heating and poor circulation, and noise.

Steam for tests furnished by Government.



An air conditioned bomb shelter was shown to throngs of visitors attending the Hamilton-Butler county sesquicentennial celebration held at Hamilton, Ohio, recently. Built of steel, the bomb shelter is equipped with a 3 hp air conditioning system for the safety and comfort of occupants. The shelter is built of 7 ga corrugated steel and is designed to be buried under at least 3 ft of earth. To provide proper drainage, a pit is dug at the bottom and filled with gravel and a drainage pipe is installed. The air conditioning duct enters the shelter through a stack at the center. (Photograph courtesy of Airtemp Div. of Chrysler Corp.)

OZONE—in Ventilation and Air Conditioning

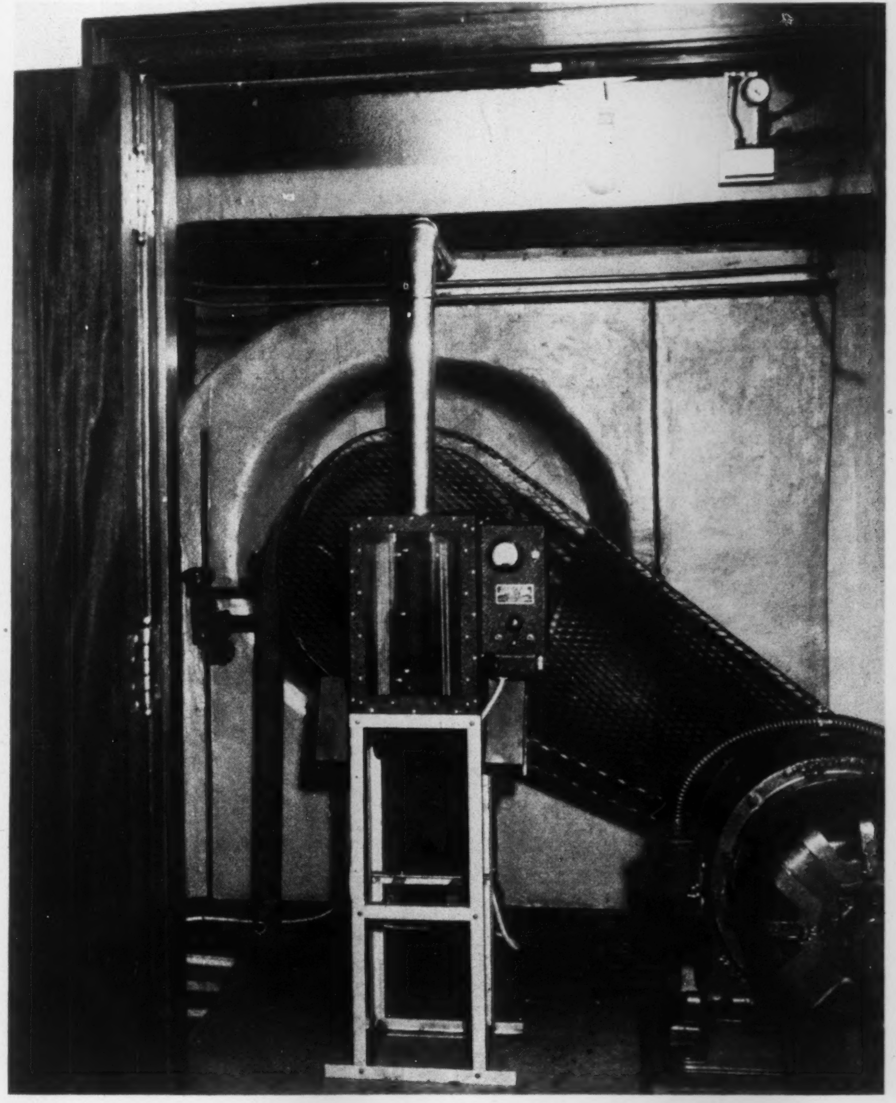
OZONE'S use in air conditioning and ventilation is characterized by strong feeling for and against. Conflicting views are cited here, and J. A. Robinson (of Ozo-Ray Process Corp.) continues with brief descriptions of three installations where the odor problem was solved. . . One is a general office in the Chicago stockyards, another is a bank building where cooking odors from nearby restaurants caused trouble, and the third is a large apartment building where ozone is supplied the corridors through ducts from the generators in the penthouses

THE use of ozone for odor control in air conditioning and ventilation is one of those subjects which the neutral observer is somewhat hesitant about approaching—those "agin" it are exceeded in the conviction of their views only by those for it.

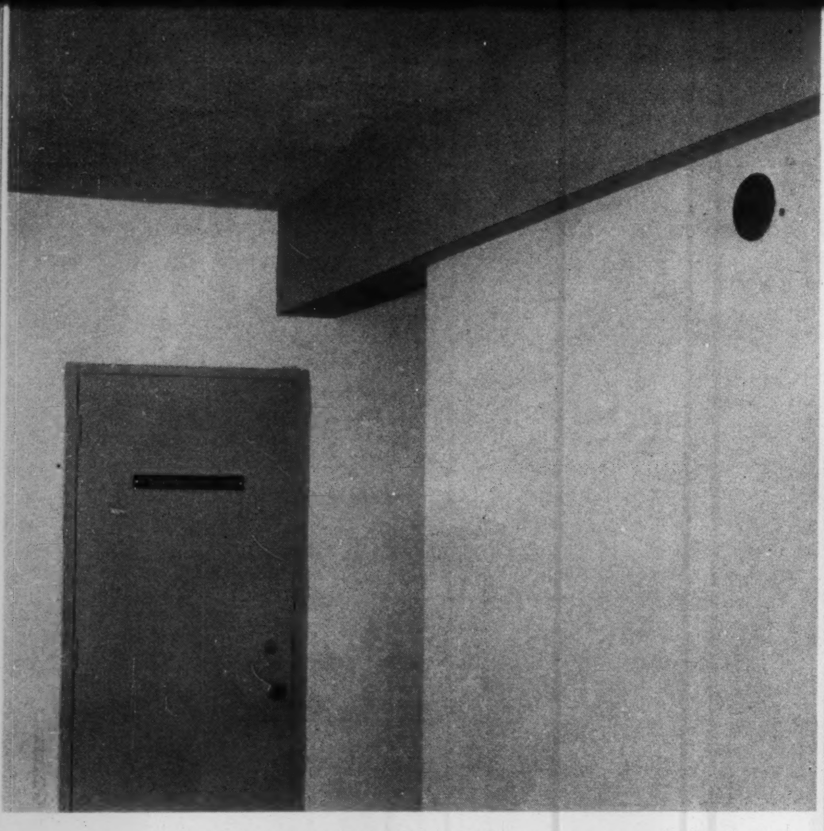
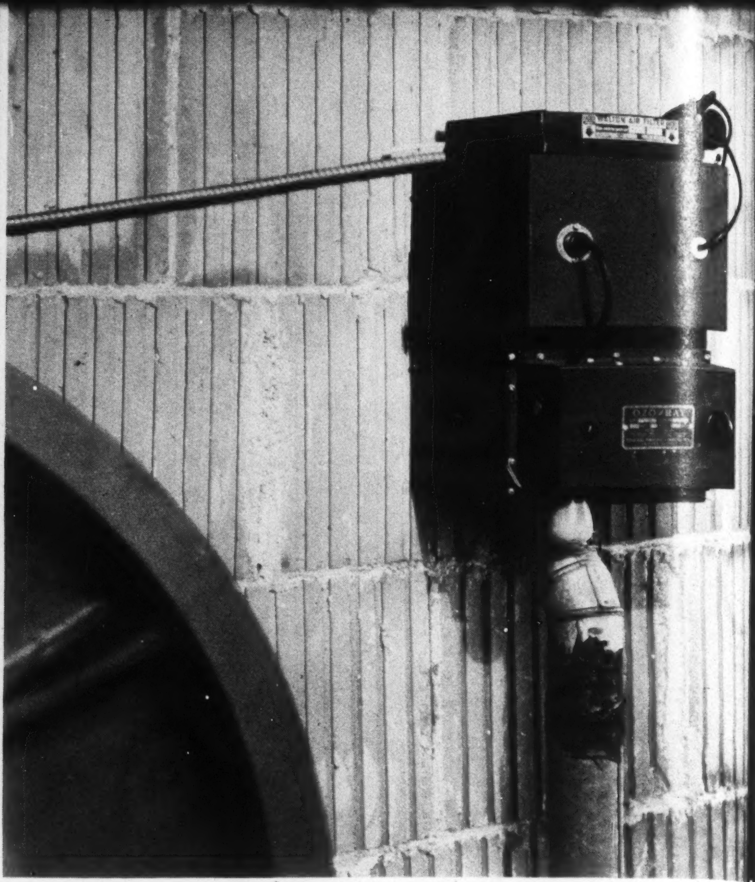
The ASHVE's Heating, Ventilating, Air Conditioning Guide 1941, for example, says: "For ordinary ventilation practice, however, neither of these purposes [destruction of micro-organisms or deodorizing] can be usefully attained [with ozone], since the concentration of ozone necessary for effectiveness would be likely to transcend the limit of comfort in ordinary occupied rooms. . . The allowable concentrations in the breathing zone are very small, between 0.01 to 0.05 ppm parts of air. . . Higher concentrations are associated with a pungent unpleasant odor and considerable discomfort to the occupants. One part per million causes respiratory discomfort in man, headaches and depression, lowers the metabolism, and may even lead to coma."

As opposed to this view, tests are reported by Clark E. Thorp in a paper on the influence of nitrogen oxides on the toxicity of ozone, which was published in the News Edition of the American Chemical Society for June 25, 1941: "These tests show a large difference of toxicity between pure ozone and ozone containing nitrogen oxides. The variance of opinion in the literature on ozone toxicity is probably due to results obtained with ozone containing varying amounts of nitrogen oxides. Ozone free of oxides of nitrogen is nontoxic in concentrations below 20 parts per million. Ozone plus nitrogen oxides may be more toxic than nitrogen alone and should be investigated further."

The ozone unit illustrated in the accompanying photographs and referred to in connection with the installations described below utilizes generating elements of a specially developed plastic dielectric with controlled characteristics. These elements produce an ultraviolet corona free from oxides of nitrogen, instead of a spark discharge. As installed for odor control in a ventilation or air conditioning system, a duct of small diameter connects the generator outlet with the main system duct, or space being treated—preferably feeding directly into the main air stream. The fan, or the



This unit feeds ozone into the main air supply duct through the small round duct shown. Air is drawn through the ozone generator by a small fan, and is filtered to prevent accumulation of dirt

An ozone generator in the penthouse serves each floor of an apartment building through a 3 in. duct running down a vent shaft. Branches from the duct terminate in a small round grille

moving air, then picks up the ozone and diffuses it.

Supply Air

One installation serves the air conditioned general offices of Libby, McNeill & Libby, in the Chicago stockyards. Over 40,000 cfm of outside air, laden with the offensive odors common in that district, picks up the ozone before it circulates through several offices and corridors, on two floors. The generator stands on the floor beside the main duct, being connected to it by a small duct. The offensive odors have been eliminated by this means without adding any noticeable ozone odor, according to Libby's construction and engineering division.

Another example of the elimination of disagreeable odors coming into a ventilating system from an outside source is represented by space rented by the Northern Trust Co. in an adjacent office building in Chicago's "loop". Exhausts from neighboring restaurants brought food odors into the air supply intake, which is situated in a wall along an alley. The problem had been particularly bad on Fridays, due to the odor of cooking fish. The ozone unit which has solved this problem feeds ozone through a small duct connecting into the air supply duct, as illustrated in the photo on the preceding page.

Previous experience at this building with a different type of ozone machine resulted in corrosion of the air ducts, which is attributed to oxides of nitrogen rather than ozone.

Corridors

Lake Michigan breezes along Chicago's north shore bring in exhilarating air, yet tenants in the new Marine Drive apartments soon began to complain because cooking odors frequently seeped from the originating kitchens into the corridors, and from there into other apartments. Renting difficulties consequently resulted.

The ozone installation at this building is rather unusual. The structure is built in wing form, eight floors high, with several apartments opening off from each interior corridor on each floor. An ozone generator in the penthouse surmounting each wing discharges into a 3 in. duct which runs down through a vent shaft, having branch ducts carrying ozone into each corridor. Every branch duct terminates in a small round grille, back of which is a restricted opening allowing only a measured amount of ozone to flow into each corridor. Over 200 apartments in this building are taken care of by six ozone generators.

In the engineering survey of an air odor problem of a processing nature, care should be taken to avoid unnecessary equipment cost by making sure that part of the odors are disposed of naturally, if surroundings will permit, before treatment is applied to the remainder. For example, in some factory processes, the source of an odor may be closely confined and the escaping gases exhausted to outside, or partially treated; or the source itself may be intensively treated, with modified treatment applied to the remaining odorous gases.

TEST FOR OIL — A helpful preliminary test for the determination of oil in boiler feedwater can be conducted by anyone. Just take an ordinary clean test tube, fill it to a depth of about 2 in. with the feedwater to be tested, and shake it in your hand for a few minutes with your thumb over the test tube opening. If at the end of a short period of shaking there is an accumulation of oil globules on the surface of the water you can be almost positive that there is oil and plenty of it in the feedwater. If at the end of the shaking period there is no evidence of globules at all, you can be fairly sure that the amount of oil in the feedwater is quite small.—S. D. Distelhorst, Cochrane Corp.

NEW HEAT LOSS FACTORS

By S. Konzo
Special Research Associate Professor
Mechanical Engineering Department
University of Illinois

FIRST and most essential step in selecting any heating plant for any building is to determine the heat loss. Many methods of determining heat losses are available, ranging from the strictly precise method accepted by the American Society of Heating and Ventilating Engineers to shortcut methods which are applicable only to rather restricted conditions.

The research staff at the University of Illinois announces a method of estimating heat losses that is not only strictly precise, but is also a shortcut method. This method involves the use of heat loss factor tables to be designated as the National Warm Air Association tables of heat loss factors. These tables will be incorporated in all the codes issued by the association.

Heat loss factors are presented for 105 different types of common construction of walls, frame partitions, ceilings, roofs, floors, windows and doors. These factors are given for design temperature differences between indoor and outdoor ranging all the way from 40 F to 100 F. See table on next page.

Following are the advantages of these new coefficients:

a) Multiplying the heat loss factor by the square feet of exposed surface gives the Btu per hr heat loss from that surface.

b) In any given locality the designer can select the column of figures appropriate for that locality.

c) There is no necessity of estimating the probable attic temperatures, temperatures of unheated closet spaces, temperatures below the floor, ground temperatures, etc., since these have all been taken into account.

d) The use of round numbers and the elimination of decimals make calculations easier and less subject to errors.

e) No corrections are necessary for inside temperatures other than 70 F if the proper column is selected.

The National Warm Air Association method will appear in printed form in a publication entitled Standard Code Application Manual to be issued shortly. Single copies will be obtainable at a cost of 40c from the National Warm Air Heating and Air Conditioning Association, 145 Public Square, Cleveland, Ohio. Quantity lots may be obtained at a discount.

These tables will be presented—and any questions pertaining to them will be answered—at the coming January meeting of the association at Philadelphia.

HEAT LOSS FACTORS

Description	Heat Transmission Coefficient	Heat Loss Factor (Multiply values shown by exposed areas in sq. ft.)									
		Design Temperature Difference, deg. F.									
	U	40	50	60	65	70	75	80	85	90	100
Exposed Walls No. 1											
(a) Frame, wood siding, paper, sheathing, studs, lath and plaster	0.25	10	13	15	16	18	19	20	21	23	25
(b) Same as (1a) substituting ½" rigid insulation for lath	0.19	8	10	11	12	13	14	15	16	17	19
(c) Same as (1a) with ½" flexible insulation between studs in contact with sheathing	0.17	7	9	10	11	12	13	14	14	15	17
(d) Same as (1c) with two air spaces	0.15	6	8	9	10	11	11	12	13	14	15
(e) Same as (1a) with 3⅝" rock wool or equivalent between studs	0.08	3	4	5	5	6	6	7	7	7	8
(f) Same as (1a) substituting 25/32" rigid insulation for wood sheathing	0.19	8	10	11	12	13	14	15	16	17	19
(g) Same as (1a) with composition siding over wood siding	0.21	8	11	13	14	15	16	17	18	19	21
(h) Same as (1a) substituting asphalt or asbestos shingles for wood siding	0.30	12	15	18	20	21	23	24	26	27	30
(i) Same as (1g) substituting ½" rigid insulation for lath	0.22	9	11	13	14	15	17	18	19	20	22
(j) Same as (1g) with ½" flexible insulation between studs in contact with sheathing	0.19	8	10	11	12	13	14	15	16	17	19
(k) Same as (1i) with two air spaces	0.17	7	9	10	11	12	13	14	14	15	17
(l) Same as (1g) with 3⅝" rock wool or equivalent between studs	0.08	3	4	5	5	6	6	7	7	7	8
No. 2											
(a) Clapboards or wood siding, studs, lath and plaster	0.35	14	18	21	23	25	26	28	30	32	35
(b) Same as (2a) with composition siding over wood siding	0.28	11	14	17	18	20	21	22	24	25	28
No. 3											
(a) 8" Brick wall—plain	0.50	20	25	30	33	35	38	40	43	45	50
(b) Same as (3a) plastered on one side	0.46	18	23	28	30	32	35	37	39	41	46
(c) Same as (3a) furred, lath and plaster one side	0.30	12	15	18	20	21	23	24	26	27	30
(d) Same as (3a) substituting ½" rigid insulation for the lath	0.22	9	11	13	14	15	17	18	19	20	22
No. 4											
(a) 12" Brick wall—plain	0.36	14	18	22	23	25	27	29	31	32	36
(b) Same as (4a) plastered on one side	0.34	14	17	20	22	24	26	27	29	31	34
(c) Same as (4a) furred, lath and plaster one side	0.24	10	12	14	16	17	18	19	20	22	24
(d) Same as (4c) substituting ½" rigid insulation	0.19	8	10	11	12	13	14	15	16	17	19
No. 5											
(a) 4" Brick and 8" Hollow Tile	0.34	14	17	20	22	24	26	27	29	31	34
(b) Same as (5a) plastered on one side	0.33	13	17	20	21	23	25	26	28	30	33
(c) Same as (5a) furred, lath, and plaster	0.24	10	12	14	16	17	18	19	20	22	24
(d) Same as (5c) substituting ½" rigid insulation for lath	0.18	7	9	11	12	13	14	14	15	16	18

Description	U	Heat Loss Factor (Multiply values shown by exposed areas in sq. ft.)									
		Design Temperature Difference, deg. F.									
		40	50	60	65	70	75	80	85	90	100
No. 6											
(a) Brick veneer—4" brick, paper, wood sheathing, studs, lath and plaster	0.27	11	14	16	18	19	20	22	23	24	27
(b) Same as (6a) substituting ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20
(c) Same as (6a) with 3⅝" rock wool or equivalent between studs	0.08	3	4	5	5	6	6	7	7	7	8
(d) Same as (6a) substituting 25/32" rigid insulation in place of wood sheathing	0.21	8	11	13	14	15	16	17	18	19	21
No. 7											
(a) 8" Hollow Tile—plain stucco exterior	0.40	16	20	24	26	28	30	32	34	36	40
(b) Same as (7a) plastered	0.38	15	19	23	25	27	29	30	32	34	38
(c) Same as (7a) furred, lath and plaster	0.26	10	13	16	17	18	20	21	22	23	26
(d) Same as (7c) substituting ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20
No. 8											
(a) 12" Hollow Tile—plain stucco exterior	0.30	12	15	18	20	21	23	24	26	27	30
(b) Same as (8a) plastered	0.29	12	15	17	19	20	22	23	25	26	29
(c) Same as (8a) furred, lath and plaster	0.22	9	11	13	14	15	17	18	19	20	22
(d) Same as (8c) substituting ½" rigid insulation for lath	0.17	7	9	10	11	12	13	14	14	15	17
No. 9											
(a) 8" Cinder Block—plain	0.42	17	21	25	27	29	32	34	36	38	42
(b) Same as (9a) plastered	0.39	16	20	23	25	27	29	31	33	35	39
(c) Same as (9a) furred, lath and plaster	0.27	11	14	16	18	19	20	22	23	24	27
(d) Same as (9c) substututing ½" rigid insulation for lath	0.20	8	10	12	13	14	15	16	17	18	20
No. 10											
(a) 8" concrete blocks—plain	0.56	22	28	34	36	39	42	45	48	50	56
(b) Same as (10a) plastered	0.52	21	26	31	34	36	39	42	44	47	52
(c) Same as (10a) furred, lath and plaster	0.32	13	16	19	21	22	24	26	27	29	32
(d) Same as (10c) substituting ½" rigid insulation for lath	0.23	9	12	14	15	16	17	18	20	21	23
(e) Same as (10a) basement wall, below grade	0.62	12	17	22	24	26	29	31	33	36	40
(f) 12" concrete block, above grade	0.49	20	25	29	32	34	37	39	42	44	49
(g) 12" concrete block, below grade	0.54	11	15	19	21	23	25	27	29	31	35
(h) 8" concrete wall, above grade	0.69	28	35	41	45	48	52	55	59	62	69
(i) 8" concrete wall, below grade	0.78	16	21	27	30	33	36	39	42	45	51
(k) 12" concrete wall, above grade	0.56	22	28	34	36	39	42	45	48	50	56
(l) 12" concrete wall, below grade	0.62	12	17	22	24	26	29	31	33	36	40
No. 11											
(a) 8" Limestone or Sandstone—plain	0.71	28	36	43	46	50	53	57	60	64	71
(b) Same as (11a) plastered on one side	0.64	26	32	38	42	45	48	51	54	58	64
(c) Same as (11a) furred, lath and plaster	0.37	15	19	22	24	26	28	30	31	33	37
(d) Same as (11c) substituting ½" rigid insulation for lath	0.25	10	13	15	16	18	19	20	21	23	25
(e) 12" limestone, below grade	0.64	13	18	22	25	27	30	32	34	37	42
(f) 16" limestone, below grade	0.54	11	15	19	21	23	25	27	29	31	35
No. 12											
(a) 12" Limestone or Sandstone—plain	0.58	23	29	35	38	41	44	46	49	52	58
(b) Same as (12a) plastered on one side	0.53	21	27	32	34	37	40	42	45	48	53
(c) Same as (12a) furred, lath and plaster	0.33	13	17	20	21	23	25	26	28	30	33
(d) Same as (12c) substituting ½" rigid insulation for lath	0.23	9	12	14	15	16	17	18	20	21	23
No. 13											
(a) 3⅝" Glass Block—corrugated surface	0.49	20	25	29	32	34	37	39	42	44	49

Description	U	Heat Loss Factor (Multiply values shown by exposed areas in sq. ft.)									
		Design Temperature Difference, deg. F.									
		40	50	60	65	70	75	80	85	90	100
Frame Interior Partitions No. 14											
(a) With lath and plaster one side; other side open	0.62	12	16	19	20	22	23	25	26	28	31
(b) Same as (14a) substituting ½" rigid insulation for lath	0.35	7	9	11	11	12	13	14	15	16	18
(c) Same as (14a) with ½" rigid insulation on opposite side	0.25	5	6	8	8	9	9	10	11	11	13
No. 15											
(a) With lath and plaster both sides	0.34	7	9	10	11	12	13	14	15	16	17
(b) Same as (15a) substituting ½" rigid insulation for lath	0.18	4	5	5	6	6	7	7	8	8	9
(c) Same as (15a) with 3⅝" rock wool insulation or equivalent	0.08	2	2	2	3	3	3	3	4	4	4
Ceilings with Attic Space above No. 16	**Combined Coefficient**										
(a) Lath and plaster, no floor above	0.32	13	16	19	21	22	24	26	27	29	32
(b) Same as (16a) substituting ½" rigid insulation for lath	0.23	9	12	14	15	16	17	18	20	21	23
(c) Same as (16a) with ½" rigid insulation on top of joists	0.18	7	9	11	12	13	14	14	15	16	18
(d) Same as (16a) with 3⅝" rock wool or equivalent between joists	0.08	3	4	5	5	6	6	7	7	7	8
No. 17	**Combined Coefficient**										
(a) Lath and plaster with tight floor above	0.20	8	10	12	13	14	15	16	17	18	20
(b) Same as (17a) substituting ½" rigid insulation for the lath	0.16	6	8	10	10	11	12	13	14	14	16
(c) Same as (17a) with 3⅝" rock wool or equivalent between joists	0.08	3	4	5	5	6	6	7	7	7	8
No. 18	**Combined Coefficient**										
(a) Steel ceiling, no floor above	0.35	14	18	21	23	25	26	28	30	32	35
(b) Same as (18a) with floor above	0.22	9	11	13	14	15	17	18	19	20	22
(c) Same as (18a) with 3⅝" rock wool or equivalent above	0.08	3	4	5	5	6	6	7	7	7	8
(d) Same as (18b) with 3⅝" rock wool or equivalent above	0.08	3	4	5	5	6	6	7	7	7	8
Ceiling—Part of roof—No Attic Space No. 19											
(a) Lath and plaster, rafter, sheathing, shingles	0.29	13	16	19	20	22	23	25	26	28	30
(b) Same as (19a) substituting ½" rigid insulation for the lath	0.21	9	12	14	15	16	17	18	19	20	22
(c) Same as (19a) with 3⅝" rock wool or equivalent between rafters	0.08	4	4	5	6	6	6	7	7	8	8
Flat Roofs with built up roofing No. 20											
(a) Wood 1" thick without ceiling, and with no insulation	0.49	22	27	32	34	37	39	42	44	47	51
(b) Wood 1" thick without ceiling, but with ½" rigid insulation (No air space)	0.28	13	15	18	20	21	22	24	25	27	29
No. 21											
(a) Wood 1" thick with lath and plaster ceiling, and no insulation	0.32	14	18	21	22	24	26	27	29	30	34
(b) Same as (21a) with ½" rigid insulation instead of lath	0.23	10	13	15	16	17	18	20	21	22	24
(c) Wood 1" thick with lath and plaster ceiling, and with ½" rigid insulation	0.21	9	12	14	15	16	17	18	19	20	22

Description	U	Heat Loss Factor (Multiply values shown by exposed areas in sq. ft.)									
		Design Temperature Difference, deg. F.									
		40	50	60	65	70	75	80	85	90	100
Flat Metal roofs with 1" Boards No. 22											
(a) Without ceiling, no insulation	0.42	19	23	27	29	32	34	36	38	40	44
(b) Without ceiling, with ½" rigid insulation	0.21	9	12	14	15	16	17	18	19	20	22
(c) Lath and plaster ceiling, no insulation	0.26	12	14	17	18	20	21	22	23	25	27
(d) Lath and plaster ceiling, ½" rigid insulation	0.18	8	10	12	13	14	14	15	16	17	19
(e) Same as (22a) with 3⅝" rock wool	0.08	4	4	5	6	6	6	7	7	8	8
Wood Floors over exposed or unheated spaces No. 23											
(a) Double floor on joists	0.34	5	7	9	9	10	11	12	13	14	15
(b) Same as (23a) with ½" rigid insulation on bottom of joists	0.19	3	4	5	5	6	6	7	7	8	9
(c) Same as (23a) with sheathing on bottom of joists and 3⅝" rock wool or equivalent between joists	0.08	1	2	2	2	2	3	3	3	3	4
Concrete Floors No. 24											
(a) Concrete floors 4" thick on ground	1.07	0	0	5	8	11	13	16	19	21	27
No. 25											
(a) Concrete floors—4" concrete; 3" cinder fill	0.66	0	0	3	5	7	8	10	12	13	17
(b) Same as (25a) with 1" yellow pine flooring on sleepers	0.29	0	0	1	2	3	4	4	5	6	7
(c) Same as (25a) with hard wood flooring on pine subfloor	0.24	0	0	1	2	2	3	4	4	5	6
Windows and Doors No. 26											
(a) Glass, single	1.13	45	57	68	73	79	85	90	96	102	113
(b) Glass, double (storm sash)—tight fitting	0.45	18	23	27	29	32	34	36	38	41	45
(c) Storm sash put up and taken down annually will probably be loose fitting. Under such conditions, recommend using	0.75	30	38	45	49	53	56	60	64	68	75
No. 27											
(a) Doors are figured the same as though they were windows (See No. 26)											

INFILTRATION No. 28 N = Not Weatherstripped W = Weatherstripped	Air Changes	I*	(Multiply values shown by cubic feet of space)								
(a) Rooms with windows on one side	N 1.0	0.018	0.7	0.9	1.1	1.2	1.3	1.4	1.4	1.5	1.6	1.8
	W 0.6	0.011	.4	.6	.7	.7	.8	.8	.9	.9	1.0	1.1
(b) Rooms with windows on two sides	N 1.5	0.027	1.1	1.4	1.6	1.8	1.9	2.0	2.2	2.3	2.4	2.7
	W 0.9	0.016	.6	.8	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.6
(c) Entrance halls and room with windows on three sides	N 2.0	0.036	1.4	1.8	2.2	2.3	2.5	2.7	2.9	3.1	3.2	3.6
	W 1.2	0.022	.9	1.1	1.3	1.4	1.5	1.7	1.8	1.9	2.0	2.2
(d) Sun rooms with many windows on three sides	N 3.0	0.054	2.2	2.7	3.3	3.5	3.8	4.1	4.3	4.6	4.9	5.4
	W 1.8	0.032	1.3	1.6	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.2

* These I factors are the B. t. u. per cubic foot of air per degree temperature rise multiplied by the number of air changes indicated.

[The heat loss in Btu per hr should be determined for each room to be heated. The heat transmission coefficient, *U*, is the Btu heat loss per hr per sq ft of surface per degree difference between the air temperatures on the heated and unheated sides of the surface.

The heat loss factor is the Btu per hr per sq ft of surface, and is the product of the coefficient *U* and the appropriate temperature difference.]

AMERICAN SOCIETY of HEATING and VENTILATING ENGINEERS

Journal Section

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Performance of a Hot-Water Heating System in the Research Home

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On January 2, 1940, the Institute of Boiler and Radiator Manufacturers entered into an agreement for cooperative research with the Engineering Experiment Station at the University of Illinois, and subsequently built, furnished, and completely equipped a house specifically for research work in steam and hot-water heating. It was completed early in January, 1941, and was dedicated as the I=B=R Research Home with appropriate ceremonies on May 23, 1941.

In the broadest sense the object of these investigations is to study, under actual service conditions, the different types of steam and hot-water heating systems, and various changes therein, from the standpoints of the performance of the systems and their component parts and the environment produced within the building. Corollary studies of the factors related to the performance of the structure are also to be undertaken.

The immediate objects of the tests discussed in this paper were to compare the operating characteristics of a one-pipe, forced-circulation, hot-water heating system under two conditions of operation, and to study some of the factors related to the heat losses from the structure.

Description of Equipment

Research Home: The Research Home, shown in Fig. 1, is a two-story structure, typical of brick veneer on frame construction, and has all of the outside walls and the second floor ceiling insulated with mineral wool bats 3⅝ in. thick. A vapor barrier, consisting of a glossy surfaced, asphalt impregnated sheathing paper weighing 50 lb per roll of 500 sq ft applied with overlapping joints and as continuous as possible to the inside of the studs of all exterior walls, between the house and the garage, and on the bottom of the second floor ceiling joists, offers resistance to the flow of water vapor from the heated spaces into the insulation or to the outdoors. The exterior walls are constructed as shown in Fig. 2 and Table 2. All windows and outside doors are weather stripped, and during the past winter two storm doors were used. Figs. 2 and 3 show the first and second story floor plans, and Table 1 gives a summary of the calculated heat losses for the house. Details of all the types of recesses are shown in Figs. 2 and 3 and Table 3.

In order to make the Home easily adaptable to future test work it was necessary to provide some special structural features, particularly in the details of the plaster construction. Removable panels of sheet rock instead of plaster were used on sections of the walls over all hot water pipes in order to insure accessibility. The radiator recesses were so constructed that radiators with recess panels having inlet and outlet grilles can be used. In order to accommodate radiators of different sizes, provision has also been made for changing the size of the recesses with minimum marring of the interior finish.

Fig. 1—Steam and Water Heating Research Home

Heating System: The initial heating plant in the Research Home consisted of a one-pipe, forced-circulation, hot-water system installed in connection with a three-section, cast-iron, oil-burning boiler having a net I = B = R rating of 63,000 Btu per hour. A diagram of the arrangement of the heating system and piping layout is shown in Fig. 4. The oil burner was of the pressure atomizing, conversion type, and was fired at a rate of 1.1 gal per hour during the on-periods, with oil weighing 7 lb per gallon having a calorific value of 19,550 Btu per pound. The refractory combustion chamber was 11 in. wide by 12 in. long by 12½ in. high, inside dimensions.

Small-tube 19-in., 4-tube, cast-iron radiators were used in open recesses below the windows. The radiators were connected to two supply loops as shown in Fig. 4. The amount of radiation installed in each room was based on a heat emission rate of 200 Btu per sq ft of

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For presentation at the 48th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Philadelphia, Pa., January, 1942.

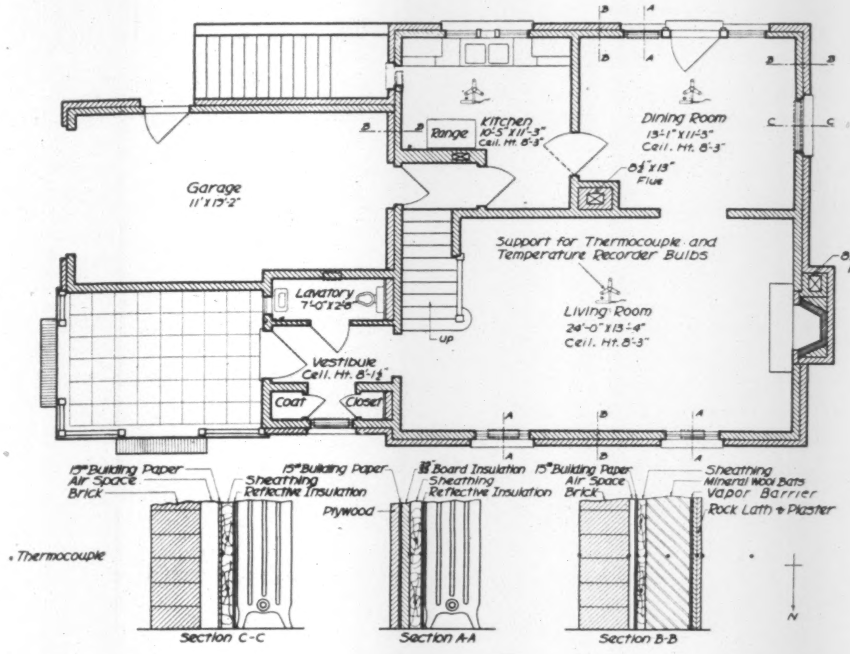
Kitchen
10'-5" x 11'-3"
Ceil. Ht. 8'-3"
Range
Dining Room
13'-1" x 11'-3"
Ceil. Ht. 8'-3"
8½" x 13"
Flue
Garage
11' x 15'-2"
Support for Thermocouple and
Temperature Recorder Bulbs
Lavatory
7'-0" x 2'-8"
Living Room
24'-0" x 13'-4"
Ceil. Ht. 8'-3"
8½" x 13"
Flue
Up
Vestibule
Ceil. Ht. 8'-1½"
Coat
Closet
15# Building Paper
Air Space
Brick
Sheathing
Reflective Insulation
15# Building Paper
Plywood
Board Insulation
Sheathing
Reflective Insulation
15# Building Paper
Air Space
Brick
Sheathing
Mineral Wool Bats
Vapor Barrier
Rock Lath + Plaster
• Thermocouple
N
Section C-C
Section A-A
Section B-B

Fig. 2—First story plan with radiator and instrument locations and radiator recess details

steam radiation with a mean water temperature of 195 F and a 10 F drop through the radiator, and was just sufficient to offset the calculated heat loss at an outdoor temperature of —10 F with the 1¼-in. circulator operating continuously.

Instruments: While the house was being constructed, approximately 100 copper-constantan thermocouples made of No. 22 B&S gauge wire were permanently installed in the building materials in order to measure temperatures at important points in the structure under various operating conditions. At each of eight locations, one on each exposure of each story, nine thermocouples were installed to provide for establishing complete temperature gradients through the walls. Other thermocouples were installed in each recess to measure the temperature of the inside and outside surfaces of the sheathing directly back of the radiator. Another group of approximately 50 thermocouples provided for the measurement of air temperatures at various levels in each room, in the attic, and in the basement. A fourth group made it possible to study the performance of the component parts of the heating system. In addition to determining the quantity of water being circulated through each radiator, provision was made for measuring the temperature of the water entering and leaving each radiator, and also the temperature of the water to and from the boiler.

All of the thermocouples were connected to selector switches on a central switchboard, located in the basement, by means of which the electromotive force of each thermocouple could be quickly read on a precision potentiometer used in connection with a highly sensitive galvanometer. One set of wall temperature gradient thermocouples in each of the four exposures could also be connected to a ten-point recording potentiometer, from which a continuous printed record of the wall temperature gradient over any desired length of time could be obtained.

Moisture measuring stations were installed in approximately 85 strategic locations in the building, conforming with recommendations made by the United States Forest Products Laboratory, Madison, Wis. The measuring stations were located at points in the building at which the moisture content of the materials was most likely to be critical or too high, and were all connected through copper lead wires to a central switchboard located in the basement. By means of the switchboard used in connection with a special moisture meter, the moisture content of the studs, plaster, sheathing, trim, floors, and wall insulation could be quickly observed.

The rate of flow of water in the mains and through each radiator in the heating system could be measured by means of a sensitive differential pressure gage, or manometer, used in connection with sixteen elbow meters.[1] These meters proved highly satisfactory for use in measuring the flow of water in the heating system inasmuch as they introduced no additional resistance to flow. Use is made of the principle that a fluid flowing through an elbow creates a difference in pres-

Table 1—Data on Research Home and Heating System

ROOM	DIMENSIONS	HEATED SPACE, CUBIC FEET	CALCULATED HEAT LOSS, BTU PER HR WITHOUT STORM SASH	INSTALLED RADIATION[a]	
				NUMBER OF RADIATORS	SQUARE FEET STEAM RADIATION
(First Floor)					
Living Room	24 ft. 0 in. x 13 ft. 4 in.	2641	5749	2	30.8
Dining Room	13 ft. 1 in. x 11 ft. 3 in.	1183	8742	2	47.6
Kitchen	10 ft. 5 in. x 11 ft. 3 in.	799	3199	1	19.6
Lavatory	7 ft. 0 in. x 2 ft. 8 in.	152	1484	1	8.4
Vestibule	7 ft. 5 in. x 5 ft. 4 in.	284	4848	1	22.4
Vestibule Closet	....	54	....	....	....
Totals (1st Floor)	....	5113	24022	7	128.8
(Second Floor)					
N. E. Bedroom	10 ft. 7 in. x 9 ft. 9 in.	800	4393	1	22.4
N. W. Bedroom	10 ft. 6 in. x 13 ft. 4 in.	1148	4944	1	25.2
S. W. Bedroom	13 ft. 0 in. x 11 ft. 4 in.	1108	5251	1	28.0
Bath	6 ft. 6 in. x 7 ft. 6 in.	374	2606	1	14.0
Stair Landing and Hall	....	505	2155	1	11.2
Closets	....	345	....	....	....
Totals (2nd Floor)	....	4284	19349	5	100.8
Totals (1st and 2nd Floors)	....	9397	43371	12	229.6
Basement	24 ft. 0 in. x 25 ft. 2 in.	5084	29276	Not being heated	

[a] All 1st and 2nd floor radiators 19-in., 4-tube, small-tube type. Recessed rating = 1.4 sq ft steam radiation per section.

Mean water temperature 195 F, drop of 10F, heat emission rate 200 Btu per sq ft per hour.
Net I = B = R Boiler Rating = 63,000 Btu per hour. Oil Nozzle 1.20 GPH.

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[1] The Use of an Elbow in a Pipe Line for Determining the Rate of Flow in the Pipe. University of Illinois Engineering Experiment Station Bulletin No. 289.

sure between one point on the inside radius and another point on the outside radius of the elbow. This difference in pressure is proportional to the rate of flow.

Recording thermometers were used to make continuous records of the air temperatures in each of the six rooms, the outdoor air, and the flue gas temperatures. The CO_2 in the flue gas was measured by means of both a thermal conductivity type recorder and an Orsat apparatus. The moisture content of the air was measured by means of four humidity indicators, one recording hygrometer, and one wet- and dry-bulb recorder which were checked periodically with an aspirated psychrometer.

Methods of Testing

During all tests reported in this paper the operation of the heating plant was controlled by a heat anticipating thermostat located 30 in. above the floor in the living room. The average room air temperature at the 30-in. level was maintained constant at approximately 72 F both day and night. At 7:00 a.m., 11:00 a.m., 3:00 p.m., 7:00 p.m., and 11:00 p.m. observations were recorded of the room air temperatures 3 in., 30 in., and 60 in. above the floor and 3 in. below the ceiling; the air temperature in the basement, the garage, and the attic; the relative humidity in the heated portion of the house; the temperature inside and outside the sheathing back of each radiator; and of the temperature gradient through the walls of the house. Complete daily records were also made of the operating time, the number of cycles and the power consumption of the oil burner and circulator, and of the weight of oil consumed. Continuous records were made of the stack temperature, the CO_2, the temperature of the water at the boiler outlet and return, the outdoor air temperature, the indoor relative humidity, and the air temperature in each room 3 in. and 30 in. above the floor and 3 in. below the ceiling. Other daily observations included the total amount of electricity and gas used in the house, the number of occupants, general weather conditions, and moisture content of various parts of the house structure such as sheathing, studs, floor joists, plaster, and finish trim.

Two series of tests were run which differed only in the operating sequence of the oil burner and circulator. In the first series, designated as series *A*, the control arrangement was that shown in Fig. 5. In series *B* the low limit aquastat was eliminated, and the flow control valve was locked open so that it could not prevent the circulation of water in the heating system at any time. With this method of control the radiators could continue to cool all of the water in the system as long as sufficient temperature difference persisted to effect any circulation by gravity, and the temperature of the water in the boiler could vary anywhere between that of the room and 200 F.

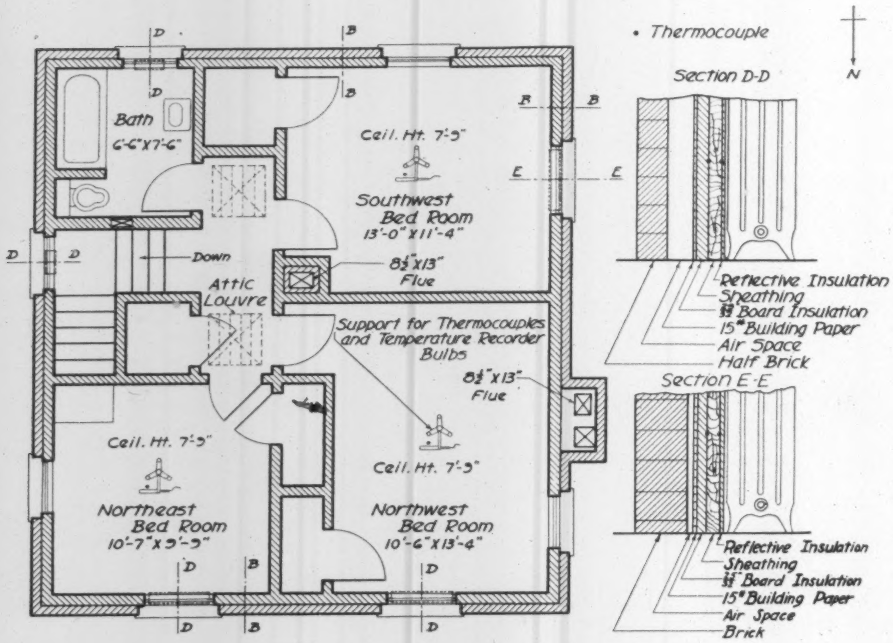


Fig. 3—Second story plan with radiator and instrument locations and radiator recess details

Results of Tests

Performance of Plant: A comparison of the burner performance curves for series *A* and *B*, shown in Fig. 6, indicates that in mild weather, or at low indoor-outdoor temperature differences, operation on series *A*, with the low limit aquastat and the flow control valve operative, resulted in increased burner operating time, burner power, and fuel consumption. These increases were caused by the larger heat losses from the chimney gases accompanying the higher average boiler water temperature maintained in mild weather in series *A* as compared with that maintained in series *B*, for which the low limit aquastat was inoperative and the flow control valve was open all of the time. As the indoor-outdoor temperature difference became larger, the average boiler water temperature for series *B* automatically approached that for series *A* as a result of the more frequent burner operation required to maintain the normal room temperature of 72 F. At approximately 55 F indoor-outdoor temperature difference, the curves for series *A* became tangent to those for series *B*, and at all temperature differences above this the operating characteristics for both series were the same, thus indicating that for indoor-outdoor temperature differences above 55 F the amount of burner operation required to maintain normal room temperature was sufficient to maintain a minimum water temperature of 165 F in the boiler during the off-periods of the burner. In milder weather the room thermostat did not operate the burner over a long enough period to maintain the boiler water at 165 F, and as a result, in series *A* the low limit aquastat continued the operation of the burner for a short time at the end of each cycle after the room temperature became normal and the circulator ceased to operate. The excess in the amount of fuel burned, power consumed, and time of burner operation shown for series *A* over that

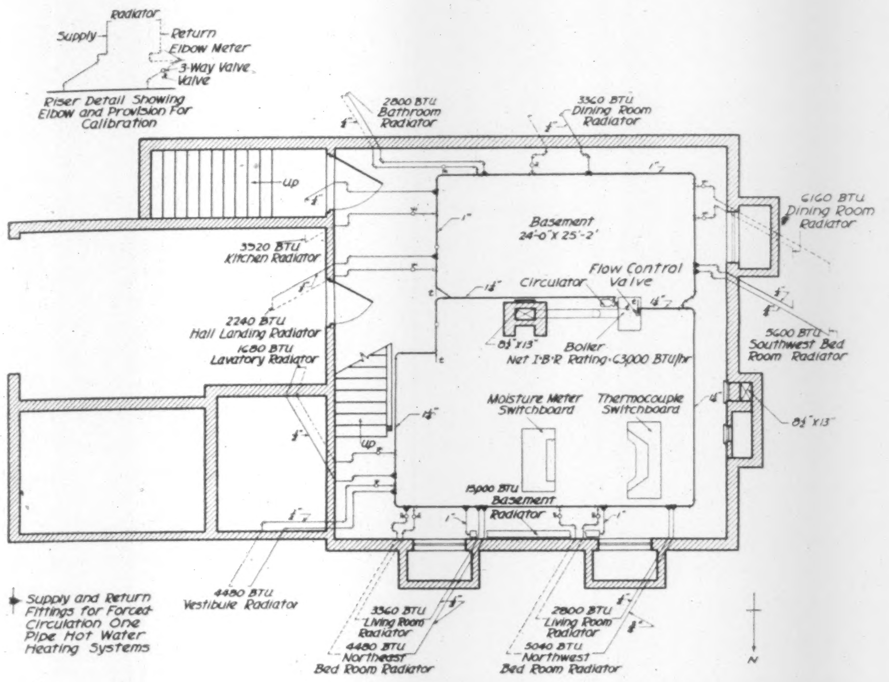

Radiator
Supply
Return
Elbow Meter
3-Way Valve
Valve
Riser Detail Showing Elbow and Provision For Calibration
2800 BTU Bathroom Radiator
3360 BTU Dining Room Radiator
6160 BTU Dining Room Radiator
3520 BTU Kitchen Radiator
2240 BTU Hall Landing Radiator
1680 BTU Lavatory Radiator
Up
Basement 24'-0" X 25'-2'
Flow Control Valve
Circulator
8½"X13"
Boiler Net I·B·R Rating·63,000 BTU/hr
5600 BTU Southwest Bed Room Radiator
Moisture Meter Switchboard
Thermocouple Switchboard
15,000 BTU Basement Radiator
1"
1½"
Supply and Return Fittings for Forced Circulation One Pipe Hot Water Heating Systems
4480 BTU Vestibule Radiator
3360 BTU Living Room Radiator
4480 BTU Northeast Bed Room Radiator
2800 BTU Living Room Radiator
5040 BTU Northwest Bed Room Radiator
N

Fig. 4—Basement plan with location of heating and testing equipment

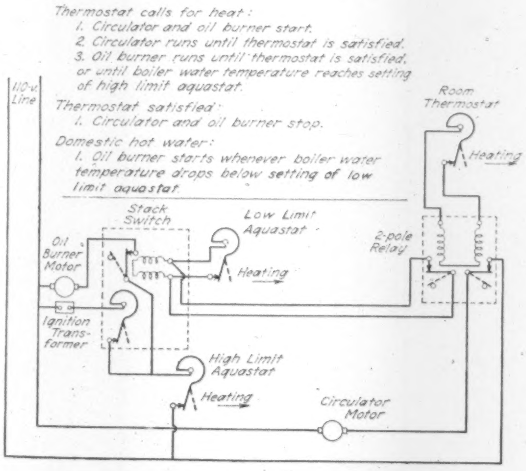
shown for series *B* is the amount of each required to maintain sufficient temperature in the boiler to make it possible to use the latter as a means of heating domestic hot water. Since the internal water heater was not connected to the hot water storage tank during these tests, the results do not include any data on the standby loss from the storage tank, or on the requirements for the actual heating of water for domestic uses.

In Urbana, Ill., the average outdoor temperature during the heating season is approximately 38 F. Hence, if the house temperature is maintained at 72 F the average heating day is one in which the indoor-outdoor temperature difference is 34 F. The average length of the heating season is 204 days. Comparisons based on this temperature difference may be regarded as indicative of the results to be secured from the entire heating season. From Fig. 6 it is evident that 33.5 and 30 lb of oil per 24 hours were required in series *A* and *B*, respectively, at an indoor-outdoor temperature difference of 34 F, or since the fuel oil used weighed 7 lb per gallon, operation on series *A* required an additional ½ gal of oil per average heating day or 102 gal per heating season over that required on Series *B*.

No significant difference existed in the number of burner operating cycles required for series *A* and *B* except in very mild weather, in which case a minimum of 9 cycles per day was required in series *A* in order to maintain a minimum boiler water temperature of 165 F.

Just enough radiation was installed in the house to offset the calculated heat loss at —10 F, when the radiators were constantly supplied with water entering and leaving at 200 F and 190 F respectively. This would require continuous circulator operation. By extrapolating the circulator operating time curve, shown in Fig. 7, to 80 F temperature difference, a total operating time of only 12 hours per day is obtained instead of 24. Superficially this would seem to indicate that the radiators were considerably oversize for the house. However, sufficient data have not been obtained at present either to confirm or to refute this. Further data will be obtained on this in future studies relating to overall house efficiency, or utilization of heat in the house.

At a given indoor-outdoor temperature difference, the circulator


Thermostat calls for heat:
1. Circulator and oil burner start.
2. Circulator runs until thermostat is satisfied.
3. Oil burner runs until thermostat is satisfied, or until boiler water temperature reaches setting of high limit aquastat.

Thermostat satisfied:
1. Circulator and oil burner stop.

Domestic hot water:
1. Oil burner starts whenever boiler water temperature drops below setting of low limit aquastat.

110-v. Line
Room Thermostat
Heating
Stack Switch
Low Limit Aquastat
2-pole Relay
Oil Burner Motor
Heating
Ignition Transformer
High Limit Aquastat
Heating
Circulator Motor

Fig. 5—Initial control system in Research Home

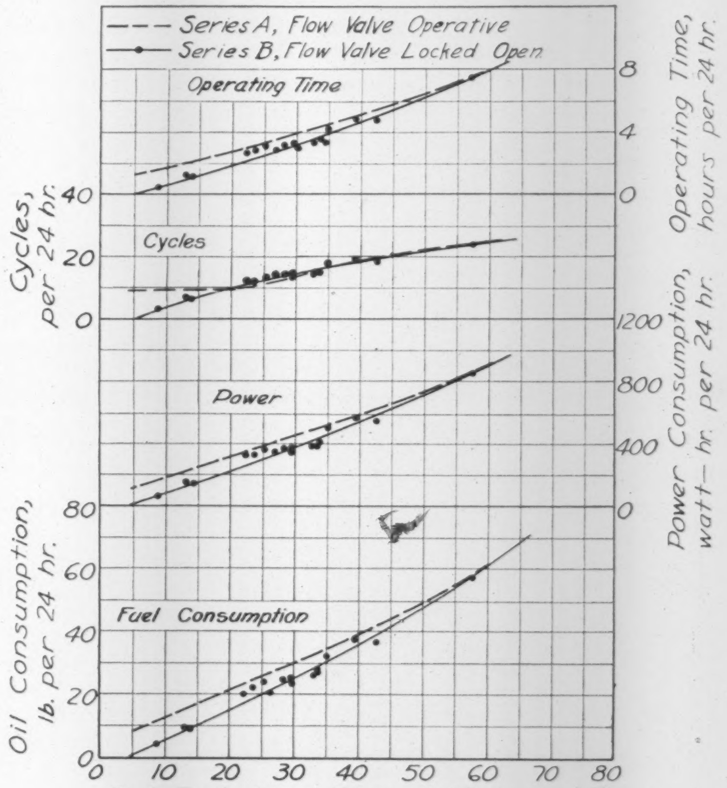


Fig. 6—Burner performance curves, Series *A* and *B*

Table 2—Equivalent Insulation Values of Materials as Used in Walls in Research Home

ARRANGEMENT OF MATERIALS AS USED IN WALLS	CONDUCTANCE FOR CONSTRUCTION STATED IN COL. 1 C	OBSERVED TEMP. DROPS THROUGH CONSTRUCTION DEG. F ΔT	THICKNESS OF CHARACTERISTIC INSULATION[b] EQUIVALENT TO CONSTRUCTION IN COL. 1 IN INCHES	
			BASED ON C	BASED ON ΔT
1	2	3	4	5
4-in. brick	2.30	2.0	0.141	0.153
½-in. air space[c]	1.10	4.5	0.295	0.345
25/32-in. wood sheathing	1.02	2.7	0.318	0.207
3⅝-in. combined mineral wool and wood studs	0.089[a]	47.3	3.625	3.625
¾-in. rock lath and plaster	4.40	0.4	0.074	0.031
9.66-in. wall as constructed	0.079	56.9	4.114	4.360

[a] Conductivity of combined mineral wool and wood studs = 0.325.

[b] Characteristic insulation assumed as one having a conductivity of 0.325 conforming with conductivity of combined mineral wool and wood studs.

[c] Not included in computed conductance for wall as constructed.

operating time, power, and number of cycles were slightly less in series *A* than in series *B*. This condition resulted from the fact that higher average radiator temperatures, and consequently higher rates of heat input to the rooms, were obtained during the on-periods of the circulator in series *A* than in series *B*.

Room Temperature Gradients: The maximum difference in the average temperature of the air at the 30-in. level observed in any two rooms of the house was 2.8 F. The maximum differences observed on the first and second stories separately were 1.2 F and 1.5 F respectively. The second story temperature averaged about 1.3 F higher than that for the first story.

With the indoor air temperature at the 30-in. level kept constant at 72 F, the air temperature difference from floor to ceiling, shown in Fig. 8, increased with decreasing outdoor air temperatures, and the method of plant operation had no material effect upon this gradient. In the coldest weather experienced there was a difference of only approximately 4.5 F between the average temperature of the air 3 in. above the floor and that 3 in. below the ceiling. That the elimination of the action of the flow control valve in series *B* caused no over-runs in the air temperatures within the house is indicated by the fact that a difference of only 0.5 F between the maximum and minimum air temperatures at the 30-in. level was obtained during a cycle of operation. The maximum variation at any level during a cycle was only 0.9 F, and this occurred near the ceiling. These values are all well within the limits of control to be expected from the average room thermostat available today.

Wall Temperature Gradients: By means of thermocouples located in the walls, as shown in section "B-B", Fig. 2, it was possible to obtain the temperature gradient through any wall at any given time.

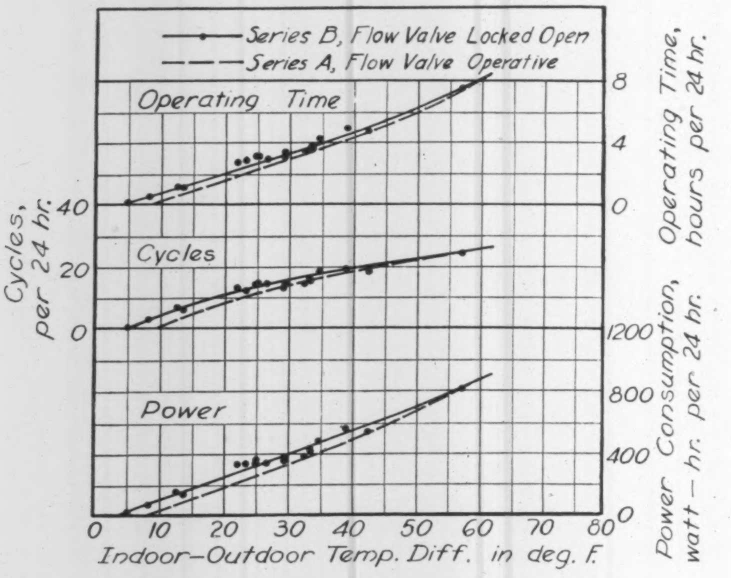


Fig. 7—Circulator performance curves, Series *A* and *B*

Fig. 9 shows a typical temperature gradient through the north wall on a day when the outdoor temperature averaged 10 F. On the assumption that a condition of steady flow of heat through the wall exists in this case, an assumption always made in the calculation of heat losses from buildings, Fig. 9 offers a means of comparing the actual insulating value of any of the building materials used in the wall with the theoretical value. If the observed temperature drops are accepted as being representative of the actual conductances of the corresponding constructions, and the drop through the 3⅝ in. combined mineral wool and studs is used as a base, then the insulating values computed from the ratios of the different temperature drops to the base drop may be regarded as actual insulating values. The insulating values computed from the ratios of the commonly accepted values of the conductances may be regarded as theoretical values. Table 2 shows equivalent insulating values computed by both methods. Column 4 expresses the theoretical thickness in inches of an hypothetical characteristic insulation having the same conductivity as that of the combined mineral wool and wood studs which would be equivalent to each of the constructions listed in Column 1. These values are based on conductance values, *C*, given in Column 2. Column 5 gives the actual thickness of the characteristic insulation equivalent to the same constructions based on the observed temperature drops given in Column 3. The actual and theoretical thicknesses were in close agreement for the brick, the insulated studding space and the total wall. Some disagreement was exhibited in the cases of the air space, the sheathing, and the rock lath and plaster. These discrepancies can probably be accounted for by deviations in the actual physical dimensions and moisture contents from those assumed for the computations. Following common practice, no air space between the brick and sheathing was allowed for in the computation of the overall conductance for the wall. However, the data indicate that in the actual wall sufficient insulating value was derived from the space between the brick and the sheathing to offset the deficiencies shown in the cases of the sheathing and the lath and plaster, so that the actual and theoretical insulating values for the total wall were in close agreement.

As shown by Fig. 9, the temperature of the inside surface of the exposed wall was only 2.8 F lower than the room air temperature. This difference remained practically constant, irrespective of the changes in the temperature outdoors and in that of the outer layers of the wall. From the standpoint of comfort the high temperature of the inside surface of the exposed walls is of considerable importance in that it reduces the amount of heat lost by the human body by radiation. Furthermore, it tends to minimize the floor to ceiling temperature difference, thus minimizing the tendency for cold floors brought about by downward currents of cold air chilled by the presence of cold wall surfaces.

Heat Transmission through Radiator Recesses: Throughout the heating season the temperatures of the inside and outside surfaces of the sheathing directly back of each radiator were observed. The records for three of the recesses are of interest, in that they show how the construction of the recesses may affect the heat loss from the house. Table 3 gives details of the construction of the cross section of each of the three recesses and of the normal wall. In Fig. 10 the observed temperature drops through the sheathing are plotted against the indoor-outdoor temperature differences for a normal wall section and for each of the three recesses. The method of operating the heating plant had no apparent effect on these temperature drops. Since the conductance of the sheathing is the same in each case, the ratio of the temperature drops through the sheathing for any two sections is also representative of the ratio of the actual heat transmission through the sections. Therefore, for any given indoor-outdoor temperature difference, if the temperature drop through the sheathing for any given recess is divided by the temperature drop through the sheathing for the normal wall, a value which may be designated as the heat transmission ratio for that recess is obtained. This figure is also equivalent to the square feet of normal wall required to transmit the same quantity of heat per hour as that transmitted by one square foot of recess area. These heat transmission ratios have been calculated for each recess and are shown plotted in Fig. 11. The isolated points represent the ratio of the calculated overall heat transmission coefficient for each recess to that for the normal wall. The discrepancies between these values and values read from the curves at given indoor-outdoor temperature differences result from the fact that the temperature back of the radiators was higher than that of the air in the room. The increase in the heat transmission ratios as the indoor-outdoor temperature difference increased was undoubtedly brought about by the fact that higher average radiator temperatures required as the weather became colder resulted in greater differences between the temperature back of the radiator and that in the room.

In interpreting these curves the values at two indoor-outdoor temperature differences should be considered. The first is at an indoor-outdoor temperature difference of 80 F, since this represents design temperature, and hence values at this difference are related to the sizing of the heating system. The second is at an indoor-outdoor temperature difference of 34 F since this represents average winter weather in Urbana, Ill., and hence, has a bearing upon the seasonal operating costs.

No —10 F weather occurred during the testing season, but by extrapolating the curves in Fig. 11 a heat transmission ratio, *R*, of approximately 10 may be obtained for the uninsulated dining room recess. That is, one square foot of area in this recess, with a *U* value of 0.245, would transmit the same quantity of heat per hour as 10 sq ft of normal wall with a *U* value of 0.074. There were 53.25 sq ft of recess area in the house, for which no allowance was made in computing the design heat loss. If every recess in the house had been of the same construction as the one in the dining room, an additional heat loss of (10—1) × 0.074 × 80 × 53.25 = 2837 Btu per hour would have resulted, or an increase of 6.55 per cent in the calculated heat loss for the house without

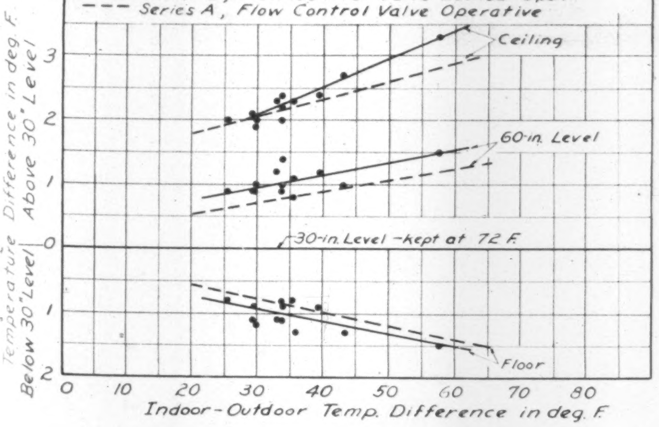


Fig. 8—Indoor air temperature differentials

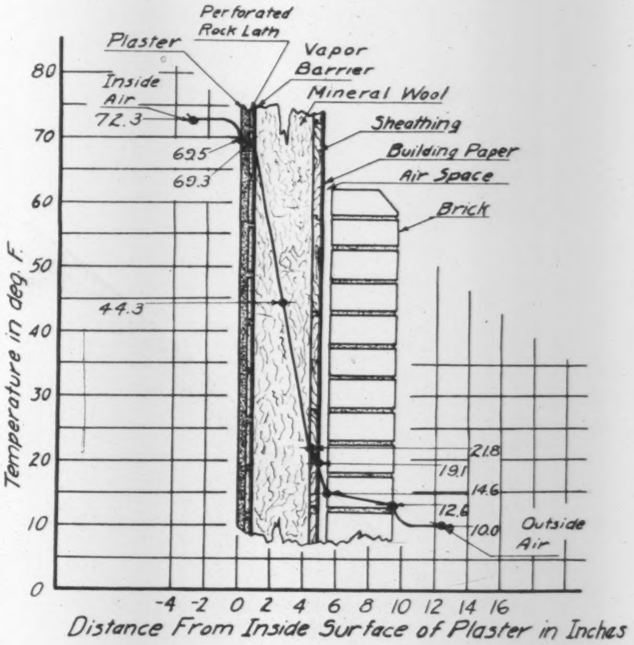


Fig. 9—Typical temperature gradient through north wall of Research Home

storm sash. This is equivalent to 10 sections of the radiation used.

Similarly, using the heat transmission ratio and the calculated heat loss at 34 F indoor-outdoor temperature difference, it may be shown that if the rigid insulation had been omitted from all of the recesses, the seasonal fuel consumption would have been increased by about 4.4 per cent over that to be expected with the use of free standing radiators.

The S. W. bedroom recess, section E-E, Fig. 3, was of the same construction as the one in the dining room except for the addition of 1 in. of rigid insulation between the brick and sheathing. The addition of this insulation changed the calculated U value from 0.245 to 0.161. Likewise the heat transmission ratio was reduced from 10 to 5.5 at 80 F indoor-outdoor temperature difference and from 6.9 to 3.7 at a temperature difference of 34 F. Thus the addition of the 1 in. of rigid insulation reduced the heat loss through the recess by

$$\frac{10 - 5.5}{10} \times 100 = 45 \text{ per cent}$$

at an indoor-outdoor temperature difference of 80 F and by

$$\frac{6.9 - 3.7}{6.9} \times 100 = 46.4 \text{ per cent}$$

at 34 F temperature difference. It is true that the actual magnitudes of the total heat losses through these recesses are small, but they do represent from 2 to 4 per cent increase in the seasonal fuel bill, and these charges continue year after year. Also, the poorest recess included in this study is comparable with what is commonly regarded as fairly high quality construction. With poorer recess construction the heat losses could easily become of such a magnitude as to seriously affect both the operating cost and the size of the heating plant required for a given installation.

Table 3—Normal Wall and Radiator Recess Construction

NORMAL WALL SECTION	RADIATOR RECESS SECTIONS		
	S. W. BED ROOM	DINING ROOM	LIVING ROOM
Lath and Plaster			
Vapor Barrier[a]			
Mineral Wool Insulation			
	Reflective Insulation	Reflective Insulation	Reflective Insulation
⅞-in. Wood Sheathing	⅞-in. Wood Sheathing	⅞-in. Wood Sheathing	⅞-in. Wood Sheathing
	25/32-in. Board Insulation		25/32-in. Board Insulation
15 lb. Felt building paper	15 lb. Felt building paper	15 lb. Felt building paper	15 lb. Felt building paper
½-in. Air Space	¼-in Air Space	1 in. Air Space	
Full Brick	Full Brick	Full Brick	¾-in. Plywood

[a] Glossy surfaced, asphalt impregnated sheathing paper, 50 lb per roll of 500 sq ft.

Operating Costs: The curves in Fig. 12 give the daily operating costs obtained over the range of outdoor temperatures experienced during the testing season. These curves were obtained by multiplying the amount of fuel and power used at various indoor-outdoor temperature differences, as shown on the burner and circulator performance curves in Figs. 6 and 7, by the three unit costs for oil and power, shown in Fig. 12, thus determining the daily cost of operation. Of the three sets of unit costs selected, the 7¼ cents per gallon for oil and the 3½ cents per kilowatt hour for power were those prevailing in Urbana, and the total cost curves calculated from these rates were used in the following seasonal cost calculation. The average heating season in Urbana consists of 204 days at an average temperature of 38 F or 5500 degree-days. Thus, with an indoor temperature of 72 F, the indoor-outdoor temperature difference on the average heating day is 34 F. The average daily total cost from the curves would be $0.38 for series A and $0.34 for series B. The total seasonal cost of operation would therefore be 204 × 0.38= $77.50 for series A, and 204 × 0.34 = $69.40 for series B. The difference, $8.10, represents additional stack losses from the boiler resulting from the maintenance of a minimum boiler water temperature of 165 F. This would be required if the boiler were used to heat domestic hot water, and this cost of $8.10 would be in addition to the cost of the fuel required to heat any domestic water used.

Summary

The following is a summary of the results obtained in this investigation:

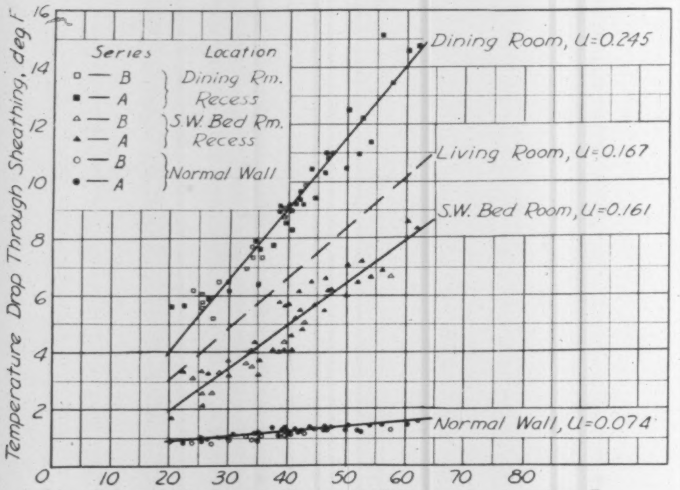


Fig. 10—Temperature drop through sheathing for three different recess constructions and normal wall

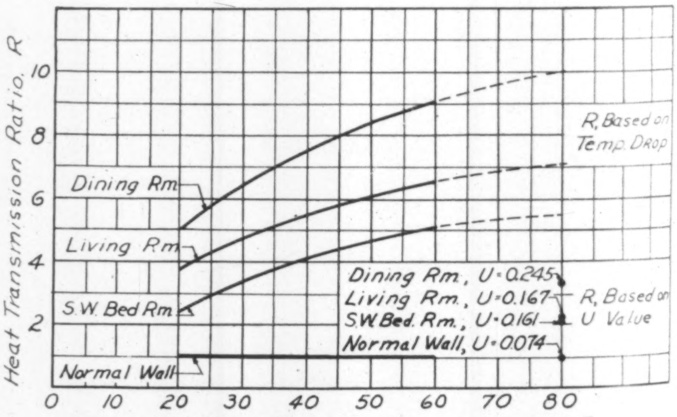


Fig. 11—Heat transmission through three different recess constructions as compared with normal wall

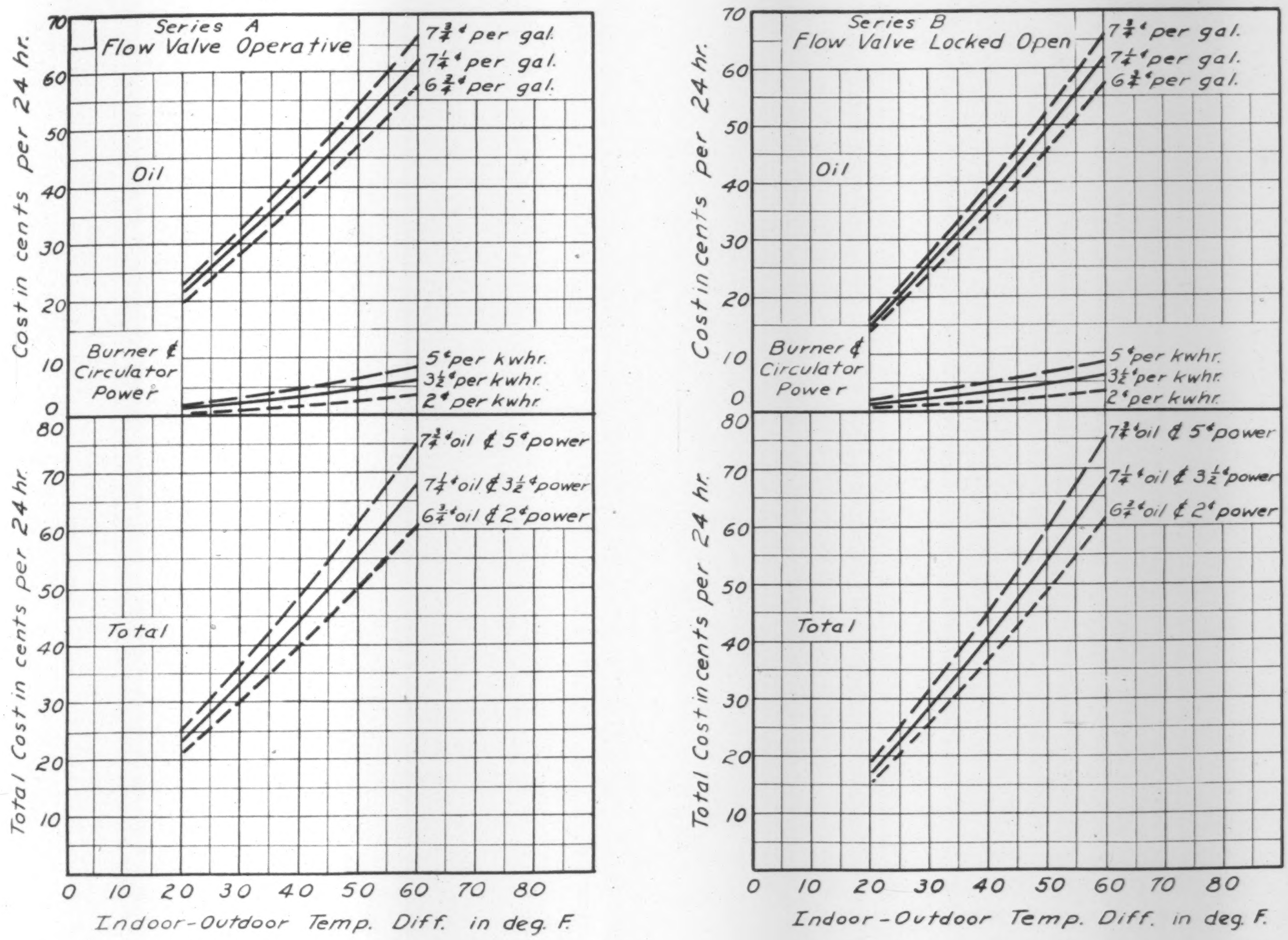


Fig. 12—Operating costs, Series *A* and *B*

▲ 1. Operation of the plant with the low limit aquastat maintaining a minimum boiler water temperature of 165 F and with the flow control valve preventing circulation of water during the off-periods of the circulator resulted in an increase in the seasonal operating cost of approximately 11.7 per cent as compared with operation with the low limit aquastat eliminated and the flow control valve locked open. The increase in fuel consumption was caused by increased heat losses from the top of the chimney accompanying the higher average boiler water temperature maintained in mild weather with the flow control valve effective.

▲ 2. No over runs in the temperature of the air in the rooms were experienced with either method of operation. The maximum variation in air temperature at the 30-in. level in any room did not exceed 1 deg F.

▲ 3. In severe weather the average difference between the temperature of the air 3 in. below the ceiling and that 3 in. above the floor was of the order of 4.5 F. The method of operating the heating system had no material effect upon this temperature difference.

▲ 4. The temperature of the inside surfaces of the exposed walls in severe weather was only about 2.8 F lower than that of the air in the rooms.

▲ 5. The application of one inch of rigid insulation to a radiator recess lined with reflective insulation, backed by wood sheathing, one inch air space and 4-in. brick veneer resulted in a reduction of approximately 45 per cent in the heat loss as compared with that lost through the same recess without insulation.

Acknowledgments

The results presented in this paper were obtained in connection with the investigation of steam and hot water heating systems in the Research Home at the University of Illinois, conducted by the Engineering Experiment Station of which M. L. Enger, Dean of the College of Engineering, is the director, and in the Department of Mechanical Engineering, of which O. A. Leutwiler, Professor of Mechanical Engineering Design, is the head. This investigation is a cooperative project sponsored jointly by the *Institute of Boiler and Radiator Manufacturers* and the Engineering Experiment Station. These results will ultimately comprise part of a bulletin of the Engineering Experiment Station. Acknowledgment is hereby made to the various manufacturers who cooperated by furnishing materials and equipment.

RADIATOR TYPES REDUCED

Simplified Practice Recommendation R174-41, Large-Tube Cast-Iron Radiators, is now available, according to an announcement of the Division of Simplified Practice, National Bureau of Standards.

The original draft of this recommendation, which was promulgated as of March 1, 1940, established a simplified schedule of 17 recommended stock sizes of large-tube radiators out of a total of 33 sizes in production at that time. The current revision further reduces the list of stock sizes to 13 by eliminating the following: 4-tube, 20-in. height; 6-tube, 20-in. height; 7-tube, 17-in. height; and 7-tube, 26-in. height.

Physiological Influence of Atmospheric Humidity

Second Report of the ASHVE Technical Advisory Committee on Physiological Reactions: C.-E. A. Winslow, Dr. P.H., *Chairman;* T. Bedford, Thomas Chester, E. F. DuBois, M.D., M. B. Ferderber, M.D., E. P. Heckel, John Howatt, R. W. Keeton, M.D., C. S. Leopold, R. R. Sayers, M.D., Charles Sheard, Ph.D., and C. Tasker

THREE years ago this Committee in its first report summarized certain general principles revealed by physiological research with regard to the desirable objectives of air conditioning. A considerable amount of new knowledge has been accumulated since 1939, particularly in connection with the influence of atmospheric humidity. In the present report, it is proposed to review the present state of information in this field with respect to the three essentially different problems involved: the influence of atmospheric humidity in cool air upon heat losses from the human body; the influence of atmospheric humidity in warm air upon heat losses from the human body; and the influence of atmospheric humidity upon the dryness of the membranes of the nose and throat.

Influence of Atmospheric Humidity in Cool Air Upon Heat Losses from the Human Body

Since one of the important avenues of heat loss from the human body is evaporation, and since a moist atmosphere tends to reduce evaporative heat loss, high relative humidity should be theoretically desirable in a cool environment. Quantitatively, however, this protective influence of a moist atmosphere is relatively unimportant for two reasons.

In the first place (as was pointed out in the first report), the extent of evaporative heat loss is small under such conditions. At 68 F, for instance, the heat loss from the clothed human body due to radiation plus convection is three times that due to evaporation (even in dry air). In the second place, the difference between the vapor pressure of a cool atmosphere (which determines evaporative heat loss) under moist and dry conditions is relatively small, as compared with the vapor pressure at the surface of the hot skin.

At 70 F, for example, the vapor pressure of water in air 75 per cent saturated is 0.56 in. of mercury and in air 25 per cent saturated is 0.18 in. of mercury. The temperature of the body surface is about 90 F and the corresponding vapor pressure 1.42 in. of mercury. The effect upon sweat evaporation of changing relative humidity from 25 per cent to 75 per cent will be proportional to the difference between 1.42—0.18, and 1.42—0.56, or between 1.24 and 0.86, a reduction of about 30 per cent. At 70 F, even in dry air, the loss of heat by evaporation is only 20 to 30 kilogram-calories per hour, hence change to a moist atmosphere can reduce the evaporative heat loss by a maximum of about 10 kilogram-calories.

This conclusion is justified by ample experimental evidence. It has been shown for the nude body at rest (Gagge, Herrington, and Winslow, 1937) for the clothed body at rest (Winslow, Herrington, and Gagge, 1938), and for the nude body in active work (Winslow and Gagge, 1941) that evaporative heat loss in cool air is less than 10 kilogram-calories greater in dry air (25 per cent relative humidity) than in moist air (75 per cent relative humidity). This increased heat loss in dry air is equivalent to a decrease in air and wall temperature of 2 F for the nude subject and 2.5 F for the clothed subject (Gagge, Winslow, and Herrington, 1938).[1]

These experimental results on heat loss, therefore, indicate that at low air temperatures it takes an increase of 20 to 25 per cent in relative humidity to compensate for a decrease of 1 F in the air temperature. This corresponds closely to a value of 23 per cent derived from the line on the ASHVE Comfort Chart for an air temperature of 60 F.[2] It is also checked by the work of Bedford (1936 and 1939) in England which indicated 24 per cent as the change in relative humidity (in cold air) equivalent to 1 F change in temperature, so far as the sensation of warmth is concerned. Bedford's more recent work (Bedford and Warner, 1939), furthermore, shows that the sensation of *freshness,* as distinct from that of *warmth* (at moderate temperatures) is *inversely* correlated with relative humidity. It is probable that this latter phenomenon is related to sensations aroused in the nose and throat, or it may possibly have some relation to odors. It seems clear, then, that at comfortable and cool temperatures humid air is psychologically undesirable and that its thermal influence in reducing evaporative cooling is negligible. There is, therefore, no physiological basis for humidifying air at moderate or low temperatures on thermal grounds.

The temperature zone in which the influence of atmospheric humidity is relatively slight will, however, vary with the metabolism of the subject, the clothing which is worn and the rate of air movement. It is limited to those conditions under which the body is not actively sweating; and, as will be pointed out in a succeeding paragraph, this critical point may vary from 60 F air temperature for a clothed subject doing active work in still air.

For presentation at the 48th Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Philadelphia, Pa., January, 1942.

[1] Throughout this report (except where otherwise stated) computations are based on such a minimum air velocity (20 fpm) as is found under ordinary indoor conditions.

[2] At 65 F the corresponding figure is 16 per cent; at 70 F, 11 per cent—all for clothed subjects.

to 85 F for the unclothed subject at rest.

As Yaglou and Messer (1941) have pointed out, certain factors such as dress are of greater practical importance in determining thermal comfort in the cool zone than a small humidity effect. They report that women in their usual thin clothing are most comfortable at 76 F, men in their warmer clothing at 71.5 F.

Although there have been relatively few studies on the responses of women to changes in the environmental temperature, such studies have revealed certain interesting sex differences. Hardy, Milhorat, and DuBois (1941) reported results on eight women studied nude in a respiration calorimeter. The heat production of the women in the cold zone was approximately the same as that of men, but the heat loss paralleled heat production much more closely than in the case of men. They also had a skin temperature about 1.8 F lower than that of men in the cold zone. This was apparently the result of better heat insulation against cold.

Under very cold conditions, high atmospheric humidity may be definitely harmful. It is well known that outdoor air is more chilling on a cold, damp day than on a cold, dry day. This phenomenon has not been studied in the laboratory. It is obviously related, not to any direct influence of atmospheric humidity upon evaporative heat loss but to increased conductive power of clothing which has absorbed moisture and consequent increase in heat loss by radiation and convection. This phenomenon can only occur under such conditions as fog and rain as will super-saturate the clothing.

Influence of Atmospheric Humidity in Warm Air Upon Heat Losses from the Human Body

In a warm atmosphere, where evaporative cooling plays a major role in the thermal adjustment of the body, the whole picture changes and relative humidity becomes a major factor in comfort.

The actual air temperature at which this occurs will vary widely according to various factors—of which clothing and metabolic activity are among the most important. The nude resting subject (semi-reclining in a chair) does not begin active sweat secretion until the air temperature reaches 85 F (Winslow, Herrington, and Gagge, 1937), while for the clothed resting subject, the limit is at about 75 F (Winslow, Herrington and Gagge, 1938). For the unclothed subject doing active physical work (riding a stationary bicycle) the onset of active sweat secretion begins at an air temperature below 68 F (Winslow and Gagge, 1941). For the clothed subject doing active work, the limit would, no doubt, be considerably lower, perhaps under 60 F.

The limits for women will tend to vary moderately from these values as a result of their somewhat individual response to temperature changes. Hardy and Milhorat (1939) reported that three normal women showed a considerable drop in heat production in a warm environment. This effect was later confirmed by the study of Hardy, Milhorat, and DuBois (1941) in which they noted that the decrease in the heat production of women in the warm comfort zone ranged from 9 to 21 per cent. As a result of this lowered heat production they did not need to sweat so much in the warm environment.

At any point above the general limits mentioned previously, evaporative cooling is a vital factor in comfort, and atmospheric humidity becomes of primary importance.

In this Zone of Evaporative Regulation, the human body shows a remarkable power of adaptation. As atmospheric (and radiational) temperatures rise above the critical point, the body responds by a beautifully balanced increase in sweat secretion so that evaporative cooling keeps pace with the need for heat dissipation. For example, one subject working on a stationary bicycle at a metabolic rate of about 300 kilogram-calories per hour was losing 250 kilogram-calories per hour by convection plus radiation and less than 50 by evaporation at a temperature of 56 F. At a temperature of 91 F the subject was losing less than 60 kilogram-calories by convection plus radiation and 240 kilogram-calories by evaporation.

While thermally effective, this process is accompanied by definite sensations of discomfort. The first condition just described for the working subject (56 F) was described by the subject as *cool* and neither particularly pleasant nor particularly unpleasant. The second condition (91 F) was reported as *very hot* and *very uncomfortable*. Yet thermal balance was success-

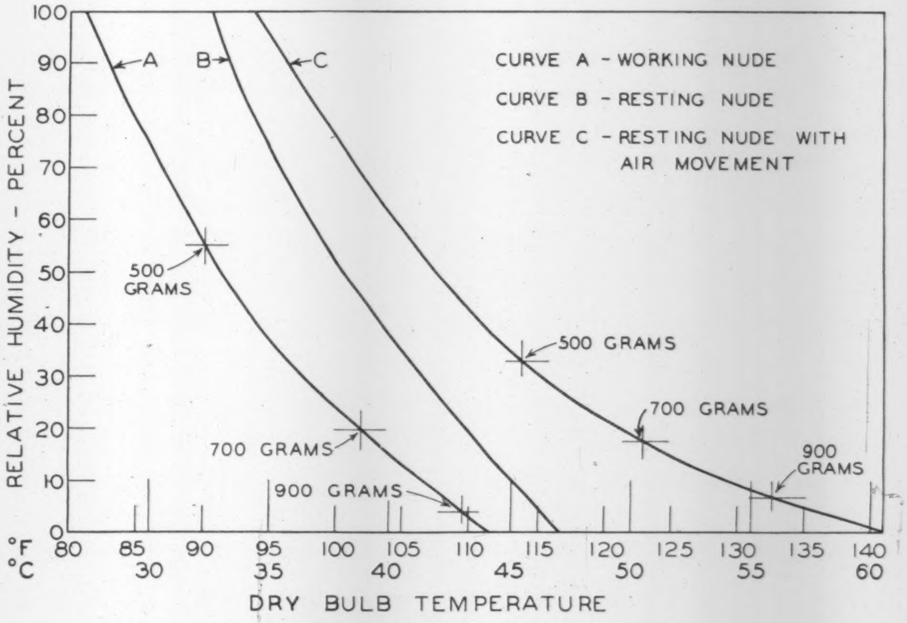


Fig. 1—Upper limits of evaporative regulation

Curve A, working, heat production 425 cal per hour, air movement 15 fpm. *Curve* B, resting, heat production 85 cal per hour, air movement 15 fpm. *Curve* C, resting, heat production 85 cal per hour, air movement 100 fpm. Crosses indicate points in limits which can be reached with indicated water loss in grams *per hour*.

fully maintained in both instances. Unpleasant sensations are reported at a short range above the temperature where active sweat secretion sets in (91 F and 75 per cent relative humidity or 99 F and 25 per cent relative humidity for the nude resting subject, 64 F with 40-50 per cent relative humidity for the nude working subject). In this range, the control of relative humidity is a primary problem of air conditioning, either decrease of temperature, decrease of humidity or increase of air movement having a powerful effect on the promotion of human comfort.

Above a certain limit, this process of evaporative heat regulation becomes impossible. This limit is set by one of two different conditions. In very hot and very dry air, it is fixed by exhaustion of the power of the body to produce enough moisture to be evaporated. In air containing much moisture, on the other hand, the limit is set by the failure of sweat to evaporate from the body surface and of course, this is the more usual condition.

Obviously, adaptive evaporative cooling can never take place in completely saturated air at or above body temperature; and in a hot atmosphere — where evaporative heat loss is vitally important—the relative humidity can be predicted at any given air temperature which will enable the body to dissipate by evaporation the amount of heat which will keep it in thermal balance. This limit can be computed (Winslow, Herrington, and Gagge, 1937) for any given rate of metabolism by constants derived in the John B. Pierce Laboratory for skin temperature, rate of convection loss and sweat secretion. Constants for these factors derived from recent studies have been used by L. P. Herrington to plot graphs, one of which is reproduced in Fig. 1. It indicates the upper limits of evaporative regulation for unclothed subjects (A) working at a metabolic rate of 425 kilogram-calories per hour in relatively still air, (B) at rest in relatively still air, and (C) at rest in air moving at a rate of 100 fpm.

At a temperature of 80 F both resting and working subjects can adjust in still air even at 100 per cent relative humidity. The resting subject can also adjust with any relative humidity at 90 F and the resting subject in rapidly moving air (100 fpm) can adjust with any humidity up to 93 F. The general slope of the lines below these points indicates the limits of possible adjustment based on the absorptive capacity of the atmosphere. The resting nude can, of course, adapt to much more extreme conditions than the working subject, and the zone of adaptation is further broadened by a high degree of air movement (100 fpm).

In line A of Fig. 1, it will be noted that at 90 F the upper limit for the working subject is at 55 per cent relative humidity; if this line were continued downward and to the right on a basis of atmospheric absorptive power, the working subject would adjust at 102 F and 20 per cent relative humidity, and at 110 F and 3 per cent relative humidity. At these points, however, the other limiting factor, the power of the body to produce sweat, comes into the picture. In this respect individuals vary widely; and the same individual may greatly increase his ability to secrete sweat. Dill (1938) has shown that a subject working in hot, dry, desert air, can double his capacity of moisture production, by practice, from 0.6 kg to 1.2 kg per hour (from a little over a pint of water to a little more than a quart). In football games much higher values have been recorded. If, however, we assume a representative figure for the normal individual, approximating Dill's initial value, it is found that above 90 F the working subject would not be able to produce the amount of moisture necessary for adjustment, even though the atmosphere could absorb it. For the working subject producing 700 g (grams) of moisture, this limit of secreting power would come at 102 F, and for the subject secreting 900 g at 110 F. The vertical lines on the graph indicate these limits, and similar limits are set for the resting nude subject in moving air; for the subject producing 500 g at 114 F, for the subject producing 700 g at 123 F, for the subject producing 900 g at about 132 F. At any point below the slope of the graph and to the left of the appropriate vertical line the subject can maintain thermal balance. Above the slope and to the right of the vertical line, the subject cannot.

The determination of these upper limits is not of concern to the ventilating engineer in ordinary practice; but it is clearly vital in connection with certain industrial processes and with the air conditioning of naval vessels.

Influence of Atmospheric Humidity Upon the Dryness of the Membranes of the Nose and Throat

Quite independent of such influences of atmospheric humidity upon thermal interchanges as have been discussed previously, is the direct influence of a dry atmosphere upon the mucous membranes of the nose and throat. Huntington (1919, 1924) has presented convincing evidence that dry climates and seasons are associated with definite increases in mortality rates; but the nature of the influence exerted has been little understood. Many physiologists have shown that, in general, the expired air approaches body temperature and 100 per cent relative humidity. Therefore, it is clear that the moisture taken from the membranes of nose and throat in respiration must vary with the temperature and humidity of the inspired air. The most exhaustive study of this subject was presented to the Society by Seeley in 1940. Seeley found that (except in very cold atmospheres) the expired air had a temperature of 90-95 F and was over 90 per cent saturated with moisture, containing 30-37 g of water per cubic meter of respired air. Since this value is approximately constant, it is clear that the drying effect on the mucous membrane must be related to the absolute—not the relative humidity of the atmosphere.

Recent studies at the John B. Pierce Laboratory of Hygiene (Winslow, Herrington, and Nelbach, 1941) have directly confirmed this conclusion. In these experiments, direct observations were made of the moisture actually present on the surface of the back of the throat (as measured by the amount of moisture absorbed by blotting paper from a given surface under standard conditions). The relation of the phenomenon to absolute humidity was confirmed; and an interesting critical point in the process was determined.

At atmospheric water vapor pressure below 0.4 in. of mercury at any temperature (from 50 to 80 F) the throat surface was very definitely dry. Between 0.4 and 0.5 in. a very marked increase in moisture was manifest, equal to a sudden doubling of the water absorbed by the blotting paper. At a still higher vapor pressure a secondary decrease in moisture on the mucous surface was observed at certain points (70 F with 70 per cent relative humidity, and 80 F with 50 per cent relative humidity) which is believed to be associated with vasomotor reactions related to the onset of sweat secretion. The point of primary interest, however, is the critical point at 0.4 in. vapor pressure. This finding means that marked drying of the membranes of the nose and throat must occur at air temperatures below 53 F with any moisture content up to saturation; at a dry-bulb temperature of 60 F with less than 77 per cent relative humidity; at a dry-bulb temperature of 70 F with less than 54 per cent relative humidity; and at a dry-bulb temperature of 80 F with less than 39 per cent relative humidity.

It should be emphasized that there is no direct evidence that the drying of the mucous surfaces is actually undesirable. The general opinion that very dry air irritates the throat and the clinical practice of treating the membranes of persons suffering from bronchial disease by soothing inhalations would seem to suggest that the problem may be of importance. If dry air is harmful, it seems obvious that its influence must be present, not merely in hot, dry air, as has often been thought, but quite as much in cold, dry air. Furthermore, it appears that, if it is desired to control the influence of dry air on the mucous membranes, a relatively high vapor pressure must be maintained corresponding at 70 F to over 50 per cent of saturation.

Bibliography

Recent Advances in Physiological Knowledge and Their Bearing on Ventilation Practice. Report of the Research Technical Advisory Committee on Physiological Reactions, C.-E. A. Winslow, Chairman. (ASHVE TRANSACTIONS, Vol. 45, 1939.)

Bedford, Thomas, 1936. The Warmth Factor in Comfort at Work. (*Industrial Health Research Board* (London), Report No. 76.)

Bedford, Thomas, 1939. (*Journal Institution Heating and Ventilating Engineers* (London), VII, 377.)

Bedford, Thomas, and Warner, C. G., 1939. (*Journal of Hygiene*, 39, 498-511.)

Dill, D. B., 1938. Life, Heat and Altitude. (*Harvard University Press.*)

Gagge, A. P., Herrington, L. P., and Winslow, C.-E. A., 1937. (*American Journal Hygiene*, 26, 84-102.)

Gagge, A. P., Winslow, C.-E. A., and Herrington, L. P., 1938. (*American Journal Physiology*, 124, 30-50.)

Hardy, J. D., and Milhorat, A. T., 1939. (*Proceedings Society for Experimental Biology and Medicine*, 41:94-98.)

Hardy, J. D., Milhorat, A. T., and DuBois, E. F., 1941. (*Journal of Nutrition*, 21:383.)

Huntington, E., 1924. World Power and Evolution. (*Yale University Press*, New Haven.)

Seeley, L. E., 1940. Study of Changes in the Temperature and Water Vapor Content of Respired Air in the Nasal Cavity. (ASHVE TRANSACTIONS, Vol. 46.)

Winslow, C.-E. A., and Gagge, A. P., 1941. (*American Journal Physiology*, *134*, 664-682.)

Winslow, C.-E. A., Herrington, L. P., and Gagge, A. P., 1937. (*American Journal Physiology*, 120, 258-299.)

Winslow, C.-E. A., Herrington, L. P., and Gagge, A. P., 1938. (*American Journal Physiology*, 124, 692-703.)

Winslow, C.-E. A., Herrington, L. P., and Nelbach, J. H., 1941. (*American Journal Hygiene.*)

NEW G-E APPOINTMENTS

D. W. McLenegan, Bloomfield, N. J., is now engineer in charge at the General Electric Bloomfield Works, and H. D. Kelsey, engineer of the air conditioning and commercial refrigeration department, has been called for the duration of the emergency to take up duties in the supercharger engineering department, as announced by J. P. Rainbault, manager of the General Electric air conditioning and commercial refrigeration department.

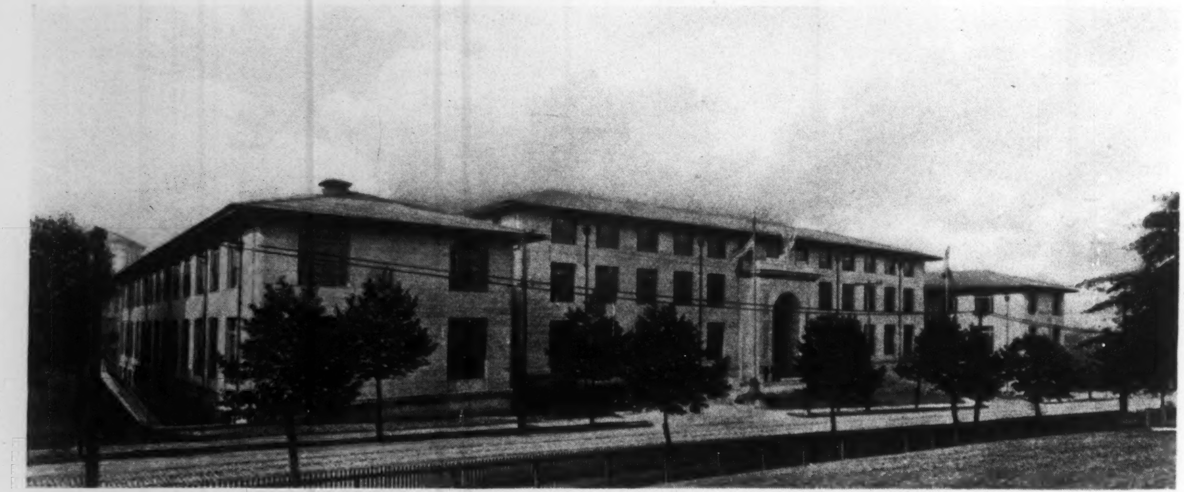
Mr. McLenegan, a native of Milwaukee, was graduated from the University of Wisconsin with a degree of B.S. in 1921. After serving as an instructor of mathematics at the University, he joined General Electric in Schenectady in 1922, and for two years was assigned to the Research Laboratory on mechanical problems. For 8 years he worked in the industrial engineering department on motor and control application and standardization, and in 1931 and 1932 he assisted in the advance work leading to the formation of the air conditioning department. He served consecutively in the commercial, commercial engineering, and engineering design sections.

Mr. Kelsey's first duty will take him to the G-E Lynn River Works plant, and later to the new G-E supercharger plant in Fort Wayne. A resident of Syracuse, N. Y., he was graduated from Syracuse University with a degree of E. E. in 1920. Before graduation he served as a student engineer with G-E in Schenectady in 1919 and entered the G-E *test* after his graduation. In 1922 he joined the turbine engineering department in Schenectady, and in 1929 went to Lynn, first with the compressor engineering department and later with the turbine engineering department and mechanical drive section. He joined the air conditioning engineering department first in Schenectady in 1933 and later went to Bloomfield.

ASHVE COUNCIL ANNOUNCES 1942 DUES RATE

Initiation Fees and Dues for 1942: Initiation Fees for Members and Associates shall be $10.00 and for Juniors $5.00. (Must accompany application.)

Annual Dues for Members and Associates shall be $18.00; Juniors $10.00; and Students $3.00 (with the privilege of purchasing THE GUIDE for $3.50). The dues of new members, with the exception of Students, shall be pro-rated quarterly from date of notification of election.



Pittsburgh Experiment Station of the U. S. Bureau of Mines where the Research Laboratory of the American Society of Heating and Ventilating Engineers is located

Radiation as a Factor in the Feeling of Warmth in Convection, Radiator and Panel Heated Rooms

By F. C. Houghten,* Carl Gutberlet** and E. C. Hach†
Pittsburgh, Pa.

SUMMARY—Reports feeling of warmth when radiation is large factor in heating effect of a room, together with results from same room equipped with convection and radiator heating. Data are given for the change in effective and mean radiant temperatures to alter the environmental conditions from ideally comfortable to either comfortably warm or comfortably cool. Relative heating requirements for the three types of heating systems are also given.

THE part which radiation plays in a person's feeling of warmth is receiving increased attention in modern heating and air conditioning applications. A research program outlined by the ASHVE Technical Advisory Committee on Radiation and Comfort[1] resulted in the building of two rooms at the ASHVE Research Laboratory in which studies were made during the past two heating seasons.

A report[2] on the results of the first season's study, when one room was heated by radiators and the other by a warm air circulating system, was presented to the 1941 Annual Meeting of the Society, and gave the relation between the mean radiant temperature and the other environmental conditions for the two rooms. As was to be expected, the mean radiant temperature was found to be higher in the radiator-heated room; however, in no test did it exceed the dry-bulb temperature of the air at the 30-in. level. The paper presented evidence on the relative effects of radiation and air temperature on a person's feeling of warmth.

In order to study this relationship when radiation was a larger factor in the heating effect of the room, and more particularly, when the mean radiant temperature exceeded the dry-bulb temperature of the air, a continued program, including the installation of ceiling heating panels in one of the two rooms and the same convection room arrangement in the other, was developed and executed during the 1940-41 heating season. The results of this continued study are the basis of this report.

A view of the two test rooms on the roof of the warehouse building of the Pittsburgh Experiment Station of the U. S. Bureau of Mines is shown in Fig. 1, while Fig. 2 is a floor plan of the two rooms, one equipped with an air circulation or convection heating system and the other with a panel heating system. The construction and arrangement of the rooms as reported earlier was not altered, except that heating panels were installed in one room and the ceiling of each room was insulated.

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**Assistant Research Engineer, ASHVE Research Laboratory.

†Research Engineer, ASHVE Research Laboratory. Member of ASHVE.

[1] J. C. Fitts, *Chairman;* A. H. Barker, L. M. K. Boelter, R. E. Daly, J. B. Fullman, E. R. Gurney, L. N. Hunter, A. P. Kratz, C. S. Leopold, D. W. Nelson, W. J. Olvany, G. W. Penney, W. R. Rhoton, C. J. Stermer, C.-E. A. Winslow.

[2] Radiation as a Factor in the Sensation of Warmth, by F. C. Houghten, S. B. Gunst, and J. Suciu, Jr. (ASHVE Journal Section, *Heating, Piping and Air Conditioning,* February, 1941).

For presentation at the 48th Annual Meeting of the American Society of Heating and Ventilating Engineers, Philadelphia, Pa., January, 1942.

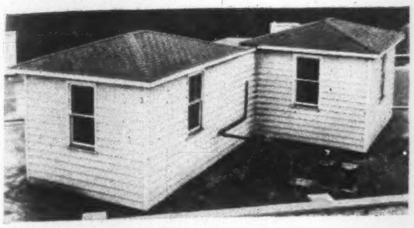


Fig. 1—View of radiation and comfort test building

The panel was constructed by placing four serpentine coils, each containing 70 ft of ½-in. standard wrought-iron pipe, against the structural insulation board ceiling of the room as earlier reported. Expanded metal lath was attached to the lower side of the coils and the entire assembly was anchored securely to the joist above with No. 8 wood screws. Cement plaster was then applied, special precaution being taken to see that it completely filled the voids between the pipe and the ceiling. Some dimensional details and arrangements of the two 6 ft 4 in. x 10 ft panels on the 12 ft x 15 ft ceiling are shown in Figs. 2 and 3.

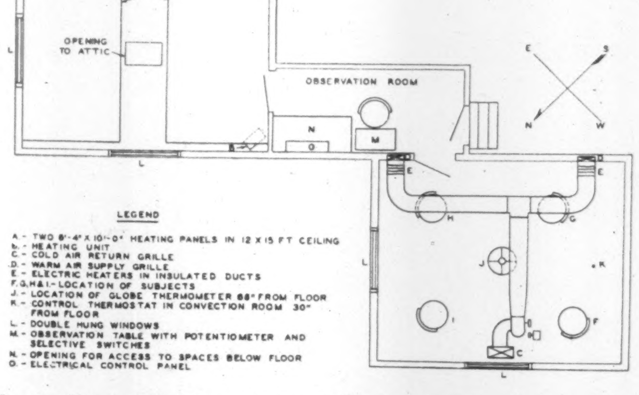
The panels were heated by a hot water system shown in Fig. 3 consisting of an insulated heater containing four bayonet heaters screwed into 2-in. pipe sections of the circuit, a hot water circulating pump, and 1-in. supply and return mains to and from the four panel coils. In order to continue the practice used in the earlier study of having as nearly as possible all of the electrical heat application within the rooms themselves, the electrical water heating unit, occupying about 1¼ sq ft of floor area, was located in the corner of the room. Supply valves gave individual control of the hot water to each of the four coils in the two ceiling panels. Mercury thermometers located in pipe tees so that their bulbs were in the water stream gave the water temperature leaving and returning to the heater. The electrical heat input to the four bayonet heaters was so arranged that part was under manual and part under thermostatic control. The part under thermostatic control was actuated by placing the sensitive element in the hot water supply line to the coils so as to maintain a constant water supply temperature. The temperature called for by the thermostat was raised or lowered by hand so as to have the desired effect on the room air. Either the manually or thermostatically controlled portion of the electric heater could be adjusted by six steps through series or parallel arrangements; this gave a convenient and wide range of control of the heat input. Arrangements were made for observing temperature at the points indicated in Fig. 4. Unless otherwise stated the dry-bulb and effective temperature given will be observations at the control station, 30 in. from the floor.

The same general arrangement of the instruments used, the number and type of the male subjects, and the clothing worn by them, and the length of the test period as reported earlier were continued in this study. Two tests, Nos. 22 and 29, were made with female subjects in evening dress.

Test Operation

The dry-bulb temperatures of both the panel-heated and convection-heated rooms were kept constant within small limits at or near the desired test temperature level for at least 12 hours prior to the beginning of any test. The slower response of the room temperature to the heat input to the panels made it desirable to alter in some respects the earlier test procedure. It was found that approximately ¾ hours elapsed between a change in the electrical heat input to the panel system and the response of the room air temperature. This made it more difficult to exercise the desired control of the room air temperature with changing outside air temperature and solar radiation. Consequently the tests were conducted in the early morning hours, usually between 3:00 and 8:00 a. m.

The subjects reported and entered the test room for a preliminary period of approximately 1 hour at about 3:00 a. m. During this period the room was controlled according to a previously determined schedule. Since it was desirable to have a slowly changing rather than a constant temperature during any given test, in order to give some range in the feeling of warmth of the subjects, and since the high heat capacity of the panel made it difficult to change at will from a constant to a rising or falling temperature, and further, since the greater heat capacity of the panel made it difficult to control the temperature on a falling time-temperature curve, most of the tests were made with a rising temperature throughout the preliminary and 4-hour test period. The dry-bulb temperature was controlled to maintain as nearly as possible the previously agreed upon effective temperature schedule in the two rooms.


OPENING TO ATTIC
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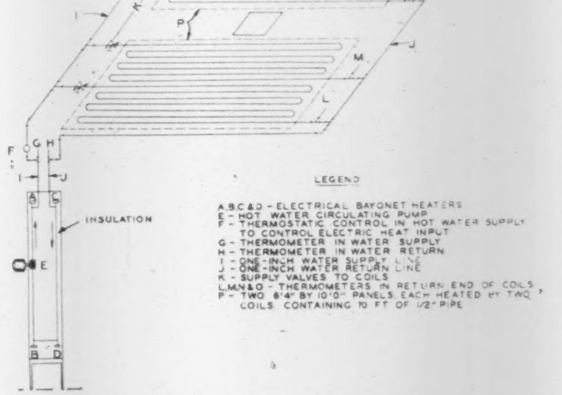
LEGEND
A. - TWO 6'-4" X 10'-0" HEATING PANELS IN 12 X 15 FT CEILING
B. - HEATING UNIT
C. - COLD AIR RETURN GRILLE
D. - WARM AIR SUPPLY GRILLE
E. - ELECTRIC HEATERS IN INSULATED DUCTS
F.G.H.& I. - LOCATION OF SUBJECTS
J. - LOCATION OF GLOBE THERMOMETER 68" FROM FLOOR
K. - CONTROL THERMOSTAT IN CONVECTION ROOM 30" FROM FLOOR
L. - DOUBLE HUNG WINDOWS
M. - OBSERVATION TABLE WITH POTENTIOMETER AND SELECTIVE SWITCHES
N. - OPENING FOR ACCESS TO SPACES BELOW FLOOR
O. - ELECTRICAL CONTROL PANEL

Fig. 2—Floor plan of two 12 ft x 15 ft test rooms and observation room. Duplicate provisions for location of subjects and measurement of all environmental conditions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LEGEND
A.B.C.&D - ELECTRICAL BAYONET HEATERS
E - HOT WATER CIRCULATING PUMP
F - THERMOSTATIC CONTROL IN HOT WATER SUPPLY TO CONTROL ELECTRIC HEAT INPUT
G - THERMOMETER IN WATER SUPPLY
H - THERMOMETER IN WATER RETURN
I - ONE-INCH WATER SUPPLY LINE
J - ONE-INCH WATER RETURN LINE
K - SUPPLY VALVES TO COILS
L.M.N.&O - THERMOMETERS IN RETURN END OF COILS
P - TWO 6'4" BY 10'0" PANELS, EACH HEATED BY TWO COILS CONTAINING 70 FT OF 1/2" PIPE

Fig. 3—Hot water system in panel room

Four of the subjects spent the first 80 min of the 4-hour test period in the

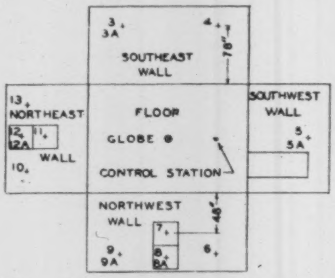

Fig. 4—Location of thermocouples in East room. Arrangement in West room identical with exception of door

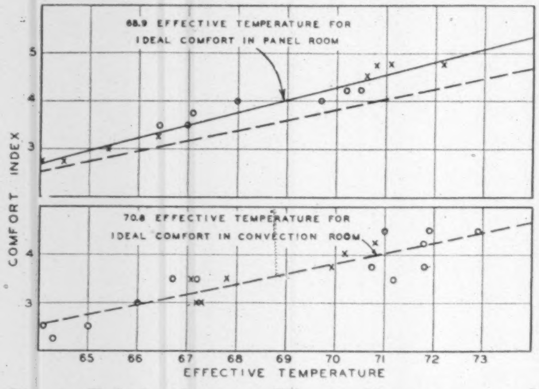

Fig. 6—Relation between Effective Temperature and feeling of comfort in panel and convection heated rooms for test 14 March 12, 1941

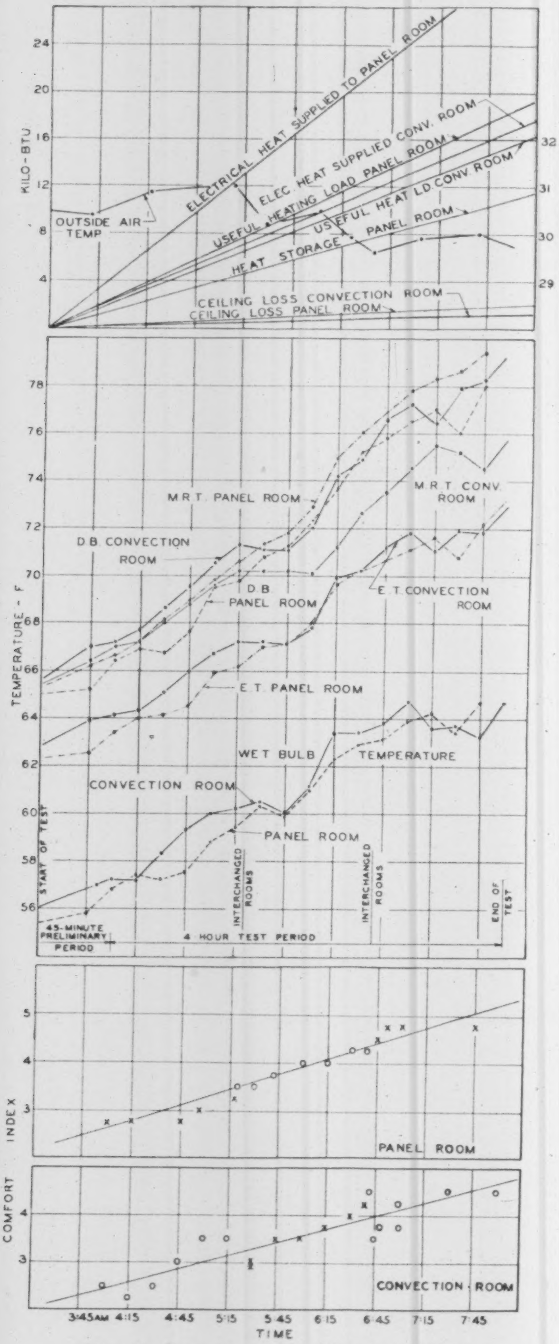

Fig. 5—Log of test 14 March 12, 1941

panel-heated room, while the other four were in the convection-heated room; these two groups then exchanged rooms for the next 80 min and then returned to their original rooms for the last 80 min. During this period a record was kept of the electrical heat input, the temperatures throughout the rooms, and the reactions of the subjects, both as regards feeling of warmth and any unusual reactions, such as local feeling of coolness, drafts, and other unusual sensations.

Test Results

The results of each test were plotted in the analysis of the test data, similar to that in Fig. 5, which is for test No. 14 on March 12, when the outside air temperature reached a minimum of 29.6 F at 6:35 a. m. The mean radiant temperature, the dry-bulb temperature, the wet-bulb temperature, and the resulting effective temperature at the 30 in. control point are plotted for each room. The heat equivalent of the electrical input, the heat loss through the ceiling for each room, the storage (positive or negative) of heat in the *panel-ceiling assembly* for the panel heated room, and the useful heat input for each room a also plotted. The useful heat inp was obtained by deducting the he storage and the ceiling loss from t heat equivalent of the electrical i put. It will be noted from Fig. that with the rising temperatu during test No. 14 the amount o heat stored in the panel, ceiling an water circulating system was a considerable part of the total heat supplied. This was determined with a fair degree of accuracy by obtaining the product of the integrated temperature rise and heat capacity of the different members of the panel-ceiling assembly. Integration of the temperature was made possible by several thermocouples placed in the ceiling structure.

The average comfort votes for the four subjects in the two rooms are plotted in Fig. 5, in accordance with an index whereby 2 is indicated as cool; 3 comfortably cool; 4 ideally comfortable; 5 comfortably warm; and 6 warm. These votes are replotted against effective temperature unaffected by radiation in Fig. 6 for the panel and convection rooms, X being used for the subjects spending their first 80 min in the panel room, and circles for those beginning in the convection room. Curves through these points indicate the time and the effective temperature at the 30 in. level when the subjects were ideally comfortable in each room. The broken line curve for the convection-heated room is superimposed on the chart for the panel-heated room for comparison. It will be noted that in this test, the subjects in the panel room were ideally comfortable at 68.9 deg ET, while in the convection room, comfort was not had until 70.4 deg ET was reached. This difference was, of course, accounted for by the approximately 1.4 deg higher mean radiant temperature in the panel room.

Pertinent data collected in the 23 successful tests are given in Tables 1 and 2. The relation between the effective temperature at which the subjects were found to be comfortable in the different tests and the elevation of the mean radiant temperature above the dry-bulb temperature, expressed either positive or negative, is plotted in Fig. 7. Triangles and squares indicate the individual test points for the subjects in the panel and convectio

Table 1—Data from 23 Tests in the Two Rooms

				Convection Room									Panel Heated Room										
				Temperatures When Subjects Were Comfortable					Heat—BTU per Hour				Temperatures When Subjects Were Comfortable					Heat—BTU per Hour					
Test Number	Date	Outside Air Temperature—F	Outside Air Velocity MPH	Effective Temperature	Mean Radiant Temperature	Dry Bulb Minus Mean Radiant	Degrees ET Change for One Comfort Index Change	Air Velocity at Globe Feet per Minute	Heat Supplied	Ceiling Loss	Useful	Useful per Deg Temp. Difference Inside Air to Outside Air	Effective Temperature	Mean Radiant Temperature	Dry Bulb Minus Mean Radiant Temperature	Degrees ET Change for One Comfort Index Change	Air Velocity at Globe Feet per Minute	Heat Supplied	Ceil ing Loss	Storage	Useful	Useful per Deg Temp. Difference Inside Air to Outside Air	Panel Useful Heat Input in Per Cent of Convection Useful Heat Input
6	2-28	20.1	11.0	70.3	70.2	4.6	2.4	15	4230	229	4001	73.5	67.8	73.0	—1.4	3.3	11	3732	482	—1425	4675	90.3	116.8
7	3-1	25.2	12.4	70.4	70.8	4.2	2.3	20	3754	48	3706	75.8	68.4	73.0	—1.4	3.5	17	6143	246	2275	3622	76.4	97.7
8	3-5	18.4	10.2	.....	.....	.....	.....	.....	.....	.....	.....	.....	68.8	73.8	—0.6	3.4	12	7314	736	2214	4364	79.6	.....
9	3-6	23.0	4.6	68.7	73.2	0.5	3.0	18	4081	400	3681	72.9	69.1	73.9	—1.6	3.4	12	6516	570	1507	4439	89.7	120.6
10	3-7	27.4	6.2	68.3	70.8	1.6	3.9	17	4041	317	3724	82.9	69.0	74.2	—0.8	3.0	15	6445	442	1572	4431	96.1	119.0
11	3-8	20.7	11.6	70.1	69.8	4.9	3.1	18	4034	246	3788	70.0	68.8	74.2	—1.2	3.1	12	6624	402	1474	4748	90.9	125.3
12	3-10	14.0	2.8	69.8	70.8	3.5	3.3	17	4777	282	4495	74.0	68.5	73.4	—1.0	3.1	11	7933	504	1638	5791	99.7	128.8
13	3-11	35.3	17.4	70.3	73.9	1.9	3.3	20	2831	202	2629	63.6	69.5	74.5	+ .01	2.9	17	4978	352	1408	3218	83.6	122.3
14	3-12	30.0	22.2	70.8	73.7	2.3	4.7	16	3550	255	3295	72.8	68.9	74.0	—1.0	3.8	11	6588	400	2325	3863	90.5	117.2
15	3-13	27.1	9.2	70.1	72.3	0.1	3.0	14	3629	282	3347	71.2	68.5	72.7	—1.5	2.9	12	6760	449	2555	3756	88.4	112.2
16	3-14	23.9	5.2	70.3	74.2	0.5	3.3	18	3826	366	3460	69.1	67.7	73.2	—1.2	2.2	12	7998	628	1998	4472	91.6	129.2
17	3-15	27.2	3.2	70.2	77.1	0.2	3.5	19	3529	387	3142	63.1	69.5	76.5	—1.4	2.6	16	6232	593	1834	3805	78.8	121.0
18	3-18	8.1	22.0	70.9	69.0	5.3	2.4	16	6500	414	6086	92.1	68.7	74.3	—1.6	2.9	13	9955	787	3165	6003	92.8	98.6
19	3-19	16.8	11.4	70.5	72.0	2.0	2.0	13	5779	352	5427	94.3	68.6	73.2	—0.4	3.0	13	9320	718	3400	5202	93.2	95.8
20	3-20	33.3	3.2	68.7	75.0	0.2	2.7	11	3392	290	3632	86.6	68.5	73.3	—0.2	3.0	12	5661	420	1900	3341	83.7	92.0
21	3-21	29.3	7.4	69.2	72.5	1.5	2.2	22	4131	305	3826	84.4	69.0	74.4	—0.5	2.9	15	6831	589	2293	3949	89.5	103.2
22	3-23	24.8	14.8	69.3	72.1	1.8	2.6	20	3800	275	3525	78.5	68.0	74.8	—1.8	2.7	11	6340	500	1939	3901	88.6	110.6
23	3-24	42.7	5.2	69.5	72.1	1.0	3.9	14	2725	194	2531	87.7	69.2	73.4	—0.6	2.4	14	4334	366	1352	2616	87.2	103.2
24	3-25	31.0	14.8	70.0	73.1	1.7	2.7	17	4500	199	4301	96.6	68.4	73.6	—0.9	2.6	13	6548	473	1759	4316	105.0	100.2
25	3-26	29.4	5.0	69.2	69.3	2.3	2.4	12	.....	.....	.....	.....	69.8	73.2	—0.8	2.9	13	.....	.....	.....	.....	.....	.....
27	3-28	34.6	4.8	69.9	75.3	0.7	3.2	15	3425	273	3152	75.9	69.6	74.9	—0.6	3.0	18	6400	550	2029	3821	96.2	121.2
28	3-29	31.1	9.6	69.5	72.0	2.0	1.5	11	3442	352	3090	68.7	69.4	76.2	—0.2	1.1	17	2150	555	—1277	2872	63.8	92.9
29	3-30	17.0	9.6	69.8	72.0	2.2	2.7	19	4995	395	4600	80.4	68.8	73.8	—0.8	2.5	15	8500	650	2850	5000	89.2	108.7
Average		25.7	9.7	69.8	72.3	2.0	2.9	16	4046	289	3783	78.2	68.8	73.9	—0.9	2.9	14	6514	519	1763	4191	88.4	111.3

rooms, respectively. For comparison the individual test points from last year's study are also given. This chart serves to indicate the difference in mean radiant temperature realized in the two studies. Whereas in last year's study, even in the radiator room, the dry-bulb-mean radiant temperature difference never reached a value below plus 0.9 deg, in this year's study a complete reversal was had so that in all panel room tests negative dry-bulb-mean radiant temperature differences were had. The lower positive dry-bulb-mean radiant temperature difference found in the convection room this year may be explained by the insulation applied to the ceiling of this room.

While there is a considerable scattering of the data plotted in Fig. 7, the curves giving the relation between the effective temperature and the mean radiant temperature are fairly consistent and conclusive. One outstanding fact of great importance and difficult of explanation is the approximately 1 deg higher effective temperature desired by the average subject in this year's test for any given dry-bulb-mean radiant temperature difference. There are several possible explanations. *First,* the fact that practically all of this year's tests were made with elevating effective temperature, while in last year's study approximately one-half of the tests were made with rising and one-half with falling temperatures, might suggest a lag in the expressed feeling of warmth. However, no such consistent differences could be found in the results for ascending and descending temperature. *Second,* a higher effective temperature might possibly be required because of some change in the prevailing habits and clothing of the subjects. However, this is hardly likely. Clothing should be a negligible factor, since in both studies all subjects were required to dress approximately alike. *Third,* it is more probable that the test in this year's study being made during the dark early morning hours from 3:00 to 8:00 a. m. may account for this difference. While no record was found in the literature of a controlled research observation of a difference in day and night heating requirement, there seems to be a prevailing opinion and practice among persons interested in the heating and temperature control of industrial plants employing both day and night workers, indicating such a difference. The tests analyzed give a very interesting demonstration of the actual existence of this fact. The difference between the day and night heating requirements may possibly be accounted for by certain radiation effects, or more plausibly, by a lowered vitality and metabolism of persons during these hours.

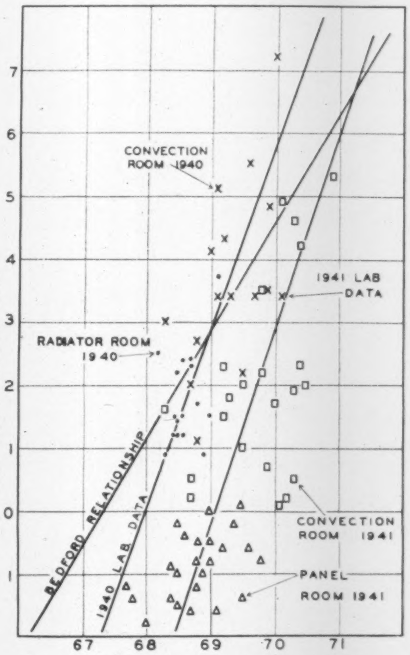

Fig. 7—Relation between Effective Temperature unaffected by radiation at which comfort was realized and difference between DB and MRT

Figs. 8 and 9 give interesting relationships between the mean radiant temperature, the dry-bulb-mean radiant temperature difference, and

Table 2—Temperatures Observed Throughout the Two Rooms at a Time During the Different Tests When the Subjects Averaged Comfortable

Type of Heating	No. Coils Used	Test No.	Date	Outside Air Temperature	Time of Observation	Central Control						Southeast Wall			Southwest Wall		Northwest Wall						Northeast Wall			
						1	2A	2B	2C	2D	2E	3	3A	4	5	5A	6	7	8	8A	9	9A	10	11	12	12A
						102"	96"	78"	30"	6"	0"	78"	78"	78"	78"	78"	78"	48"	78"	78"	78"	78"	78"	48"	78"	78"
						X	Y	Y	Y	Y	X	X	Y	X	X	Y	X	G	G	YG	X	Y	X	G	G	YG
Convection	4	6	2-28	20.4	3:30	72.2	75.2	74.5	74.8	74.4	71.4	68.7	73.6	69.5	68.8	73.5	68.5	47.2	47.0	66.6	67.9	73.8	68.0	47.4	47.1	67.8
	4	7	3-1	26.1	3:15	72.2	75.1	75.1	75.0	73.6	69.6	69.1	73.6	69.4	69.4	74.5	68.5	49.4	49.1	67.8	68.2	74.4	67.9	49.1	48.2	67.2
	4	8	3-5	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....
	2	9	3-6	23.2	6:10	73.0	74.0	74.1	73.7	72.7	70.4	68.0	72.5	68.6	68.4	73.6	67.6	48.4	48.1	67.1	67.4	73.9	67.6	48.7	48.6	67.2
	2	10	3-7	27.4	5:25	70.6	73.3	73.0	72.4	70.7	69.3	68.0	71.4	68.2	68.2	71.6	69.1	49.6	49.1	65.0	68.6	70.9	69.0	49.3	49.1	64.6
	2	11	3-8	20.6	5:11	72.0	76.6	76.1	74.7	71.8	67.7	67.4	73.2	67.8	66.2	74.9	67.0	46.7	46.0	64.9	67.7	73.7	67.2	46.6	46.4	64.7
	2	12	3-10	13.6	5:41	72.4	73.5	75.8	74.3	71.5	70.5	65.8	73.8	66.0	67.0	74.9	65.7	45.0	44.7	62.7	66.0	75.0	65.8	44.2	43.9	62.9
	2	13	3-11	34.5	6:08	73.9	76.9	76.6	75.8	73.9	73.1	70.7	74.5	70.6	70.3	76.1	70.8	57.0	54.7	69.8	70.6	76.4	70.4	56.2	55.1	69.7
	2	14	3-12	29.7	6:48	72.1	76.2	75.8	74.9	71.6	67.4	69.0	73.8	68.8	68.2	74.7	68.9	52.4	52.0	67.0	68.7	75.0	68.5	52.7	52.1	67.3
	2	15	3-13	25.4	6:09	71.8	72.6	72.8	72.4	71.2	70.9	67.6	72.0	67.7	68.1	73.0	68.0	50.3	48.3	64.4	67.9	72.5	67.2	49.0	48.5	65.2
	2	16	3-14	24.6	7:06	70.9	75.6	75.4	74.7	73.3	72.3	67.8	74.5	67.6	67.5	75.2	67.1	49.6	49.0	65.8	67.3	73.4	66.8	47.8	47.7	66.4
	2	17	3-15	27.5	6:40	75.7	78.5	78.3	77.3	77.1	73.7	70.2	75.8	72.4	71.1	77.5	68.6	52.6	51.3	71.4	68.5	76.3	71.8	51.1	49.7	70.7
	2-4	18	3-18	8.2	7:00	70.4	74.1	74.2	74.3	71.0	68.0	65.0	73.1	65.5	64.2	73.0	64.4	40.8	40.0	61.5	64.9	73.5	64.1	40.2	39.2	60.4
	2-4	19	3-19	16.5	5:48	71.3	74.6	74.3	74.0	72.8	69.8	66.1	72.9	66.8	67.4	72.0	66.7	46.2	45.0	66.3	66.6	74.2	67.3	45.4	45.0	66.2
	2	20	3-20	33.3	5:15	72.2	76.1	76.1	75.2	74.7	70.7	69.7	73.8	69.6	68.4	74.2	69.6	52.6	49.7	64.6	69.3	73.5	69.0	54.4	48.6	63.5
	2	21	3-21	28.7	5:18	72.3	74.8	74.1	74.0	73.0	70.3	69.4	73.1	69.9	69.8	75.7	69.0	51.6	50.8	68.0	69.7	73.5	70.1	52.6	50.4	68.7
	2	22	3-23	29.0	6:45	70.8	75.2	74.7	73.9	71.4	69.9	68.6	70.7	68.0	68.6	72.6	68.7	50.7	49.1	62.5	68.4	72.2	69.0	50.6	49.4	62.4
	4	23	3-24	42.5	5:24	72.0	74.0	73.6	73.1	72.4	71.5	71.0	73.9	71.7	71.2	74.8	71.5	58.5	57.9	67.2	71.3	74.3	69.2	59.3	57.4	67.0
	4	24	3-25	30.3	5:41	72.9	75.8	76.3	74.8	72.0	71.0	68.5	73.6	68.4	69.5	74.0	68.4	53.0	52.0	66.1	68.8	74.9	68.6	52.0	51.2	67.0
	4	25	3-26	29.4	6:00	71.0	75.3	74.9	71.6	70.6	69.0	68.8	70.9	68.1	68.8	72.8	68.9	50.9	49.3	62.7	68.5	72.4	69.1	50.8	49.3	62.5
	2	27	3-28	34.5	6:35	74.4	76.4	76.5	76.0	75.6	74.7	70.7	74.4	71.3	70.8	75.3	70.6	54.4	53.4	68.9	70.3	75.7	70.8	51.9	54.9	69.3
	2	28	3-29	31.1	6:54	71.2	74.3	74.1	74.0	72.6	69.7	69.2	73.0	68.8	69.1	73.9	69.0	52.7	51.8	65.8	68.4	73.2	69.0	52.9	52.5	66.0
	2	29	3-30	17.0	6:25	71.2	74.5	74.3	74.2	72.7	69.7	66.0	72.8	66.7	67.3	72.0	66.8	46.2	45.1	66.2	66.5	74.2	67.2	45.6	45.8	66.1
Panel		6	2-28	19.8	2:30	77.6	76.1	75.2	71.6	71.0	73.4	70.4	73.8	69.9	69.0	73.5	68.6	47.0	47.5	68.0	68.0	74.1	68.1	47.1	47.3	68.5
		7	3-1	24.2	3:09	77.5	75.7	73.2	71.6	69.8	71.9	71.1	73.9	71.3	69.5	74.6	69.6	49.1	49.9	66.8	68.8	78.7	69.5	49.2	48.3	67.3
		8	3-5	18.4	5:53	88.8	78.8	76.9	73.2	71.2	73.4	70.2	74.5	70.4	69.3	76.7	68.7	46.0	48.6	66.2	68.7	77.2	68.1	45.7	48.2	65.1
		9	3-6	22.8	6:22	82.4	77.2	75.6	72.3	71.0	72.6	69.8	73.0	69.8	68.6	74.7	69.4	48.5	49.6	67.2	68.3	74.0	68.5	49.0	49.3	67.4
		10	3-7	27.3	5:58	84.4	78.1	76.6	73.4	71.5	72.8	69.9	74.0	69.9	69.6	75.5	70.2	50.2	50.8	67.2	69.4	76.2	69.2	49.3	49.5	68.5
		11	3-8	20.8	5:52	98.8	80.2	77.8	73.0	70.8	73.4	71.0	74.2	70.0	70.8	76.9	69.5	46.6	48.2	65.4	69.9	77.2	68.5	47.3	48.8	64.9
		12	3-10	14.3	5:28	102.5	80.1	77.2	72.4	70.4	73.6	70.4	74.5	69.7	69.8	77.2	68.9	45.0	45.7	67.3	68.3	77.0	68.0	44.5	45.4	66.3
		13	3-11	36.1	6:00	87.3	80.6	78.0	74.6	73.5	74.0	72.6	75.3	72.1	74.3	78.8	72.5	56.1	56.9	69.3	72.4	78.9	72.7	56.6	56.7	69.4
		14	3-12	30.3	6:08	97.0	79.6	77.6	73.0	72.0	73.3	70.3	75.1	70.0	69.8	75.7	69.6	52.3	53.7	67.7	68.7	75.2	69.1	53.0	53.5	68.8
		15	3-13	28.7	5:46	88.3	75.6	74.1	71.2	69.8	71.6	70.4	72.1	71.0	68.2	74.3	71.4	51.3	49.8	64.9	71.2	73.7	68.1	49.6	49.4	65.0
		16	3-14	23.2	6:08	91.6	76.7	73.1	72.0	71.2	72.6	70.8	74.5	68.9	67.6	75.2	68.5	51.3	49.1	65.7	69.6	74.8	68.9	47.4	48.0	68.9
		17	3-15	26.8	6:27	99.1	82.1	80.0	75.1	73.6	75.2	74.7	76.7	75.2	73.1	79.0	68.7	54.6	52.5	71.2	68.6	79.8	72.8	50.8	50.3	74.7
		18	3-18	8.0	6:34	107.2	84.0	80.5	72.7	70.0	71.5	69.0	76.5	70.1	69.0	80.4	68.0	41.0	41.9	68.0	67.8	77.0	69.8	40.0	40.6	69.3
		19	3-19	17.0	5:14	100.4	81.3	77.5	72.8	69.9	71.8	69.2	74.8	69.5	70.4	78.4	68.7	46.9	45.1	66.9	68.9	78.9	70.5	45.8	46.8	67.6
		20	3-20	33.2	5:15	83.2	77.2	75.1	73.1	71.6	73.2	71.2	74.9	71.5	68.9	75.2	71.1	53.3	51.2	65.9	69.6	76.6	70.6	54.0	52.0	70.7
		21	3-21	29.8	5:06	81.8	76.7	75.8	73.9	72.1	72.7	71.7	77.0	71.5	70.2	76.4	70.6	53.3	51.4	68.3	69.8	77.5	70.5	52.2	52.1	69.8
		22	3-23	29.0	6:00	83.0	76.2	74.9	73.0	70.9	72.0	70.2	72.1	69.7	69.4	74.7	70.3	50.3	49.5	68.0	71.2	74.1	70.7	50.4	50.5	69.8
		23	3-24	42.8	5:08	77.4	75.9	74.7	72.8	72.2	71.7	74.5	76.4	74.8	74.5	75.6	74.0	59.7	58.7	68.0	73.6	75.7	73.0	59.3	59.1	71.4
		24	3-25	31.6	5:11	82.7	77.4	74.9	72.7	71.5	72.7	70.5	73.6	70.8	71.0	75.8	70.8	53.3	52.4	68.1	69.5	76.3	70.3	51.0	51.6	71.8
		25	3-26	29.3	6:06	80.9	76.4	75.1	72.4	71.1	72.1	70.4	72.3	69.9	69.5	74.9	70.4	50.5	49.4	68.2	71.3	74.3	70.8	50.5	50.2	70.0
		27	3-28	34.6	6:41	78.9	77.2	76.1	74.3	73.5	75.6	72.3	74.7	72.2	71.0	75.4	71.4	54.5	55.0	69.2	70.6	75.7	71.1	55.0	55.5	72.8
		28	3-29	31.0	6:48	86.1	79.7	78.5	76.9	75.7	77.5	71.7	76.2	71.9	72.7	77.2	71.0	53.7	53.8	72.2	71.4	77.4	71.8	54.0	54.6	76.1
		29	3-30	17.0	6:10	98.6	80.2	78.1	73.0	70.2	71.9	69.1	74.7	69.5	70.3	78.3	68.6	46.8	46.2	66.8	68.8	78.7	70.4	46.0	46.7	67.5

Location of observation points as indicated in Fig 4. Distances measured from floor.
Therefore: 0 in. = Floor surface.
102 in. = Ceiling.
X = Surface temperature.
Y = Air temperature.
G = Glass surface temperature.
YG = Air 6" from glass surface.

the dry-bulb temperature in the two rooms, and the outside dry-bulb temperature at the time when the subjects were comfortable. The single point on each curve at slightly under 74 F outside temperature was determined in connection with last year's study as representing an equilibrium condition, when the mean radiant temperature and the dry-bulb temperature of the atmosphere were all the same with 68 deg ET and 40 per cent relative humidity. This point was established by tests in the Laboratory's psychrometric rooms for winter conditions and reported in last year's study. This point serves admirably in fixing the shape of the curves.

The same tendency for the mean radiant temperature to compensate for falling outside temperature as was experienced in the radiation and convection rooms last year is indicated for the panel and convection rooms this year; even to a slightly greater extent. In the convection room, where radiation is a lesser factor, the mean radiant temperature goes down progressively with falling outside temperature, due to the colder inside surface of the outside walls and windows. The slightly lesser downward trend in this year's convection room results undoubtedly comes from the application of insulation above the ceiling. In the panel-heated room the necessary elevation in the panel surface temperature in order to provide the increasing amount of heat with falling outside temperature tends to offset the falling inside surface temperature of the outside walls, so as to keep the mean radiant temperature constant for the entire series of tests. It should be also emphasized that not only does the elevated temperature of the panel surface serve to raise the mean radiant temperature, but that also, the increased radiation from the panel raises somewhat the temperature of all surfaces in view of the panel, including the inside surfaces of outside walls and glass, the floor, the occupants' clothing, the furniture and the furnishings. This will be clearly indicated in a comparison of these surface temperatures in the tabulated data.

The effect of the elevated mean radiant temperature in the panel heated room with falling outside temperature serves to stabilize the relationship between outside air temperature and the difference between the inside dry-bulb temperature at the central control point and the mean radiant temperature. In the convection room the value of this difference, or the depression of the mean radiant temperature below the dry-bulb temperature, increases progressively with falling outside temperature. Again the effect of the insulation of the ceiling is shown by the lower slope of the curve for this year's data. In the panel-heated room most of these values become negative; that is, the mean radiant temperature was always equal to or greater than the dry-bulb temperature unaffected by radiation at the control point at the time of comfort.

The dry-bulb temperature at the control point in the convection room required elevation with falling outside temperature in order to compensate for the increased radiation effect from the subjects to surrounding surfaces resulting from the lower mean radiant temperature. Again the effect in the convection-heated room this year is decreased; in fact, almost to the extent of disappearance, due to the added insulation, while in the panel heated room, the elevation of the mean radiant temperature above the dry-bulb temperature gave sufficient compensation so that with lower outside temperatures there seems to be some tendency for a lower rather than a higher dry-bulb temperature to be required. In this connection, it may be well to indicate that another disturbing factor serves to lower slightly the dry-bulb temperature in this year's study, namely, the relative humidity maintained within the rooms. As pointed out above, the relative humidity could only be controlled within certain limits. It was felt desirable to maintain somewhat lower relative humidities for the colder outside temperatures in order to avoid condensation on the windows, since this disturbed the window condition as well as giving a false indication of the heating requirement. As an average, slightly higher relative humidities were maintained in this year's tests, necessitating a lower dry-bulb temperature for the same effective temperature.

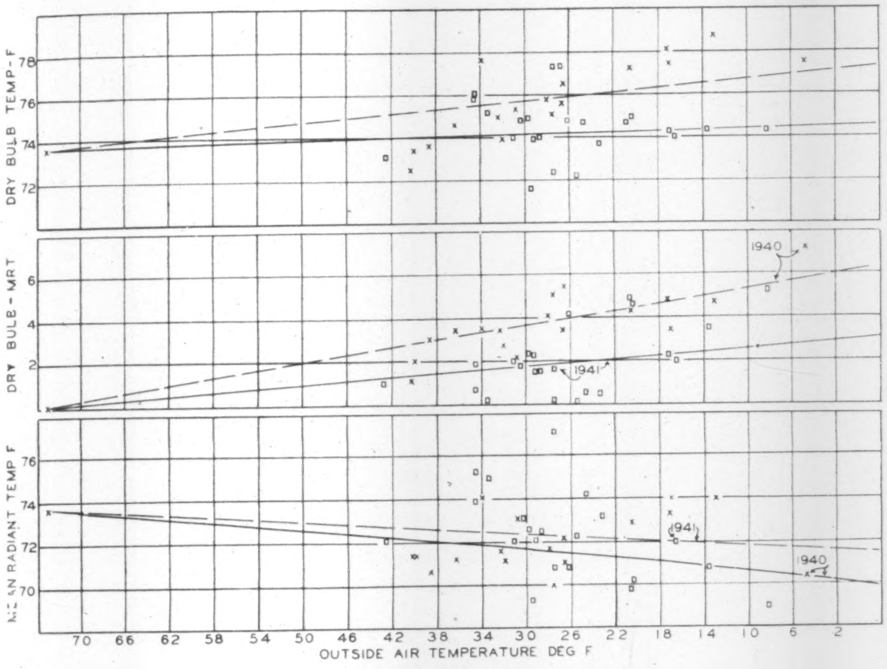

Fig. 8—Relation between OS dry-bulb temperature and MRT, dry-bulb MRT and dry-bulb for convection room

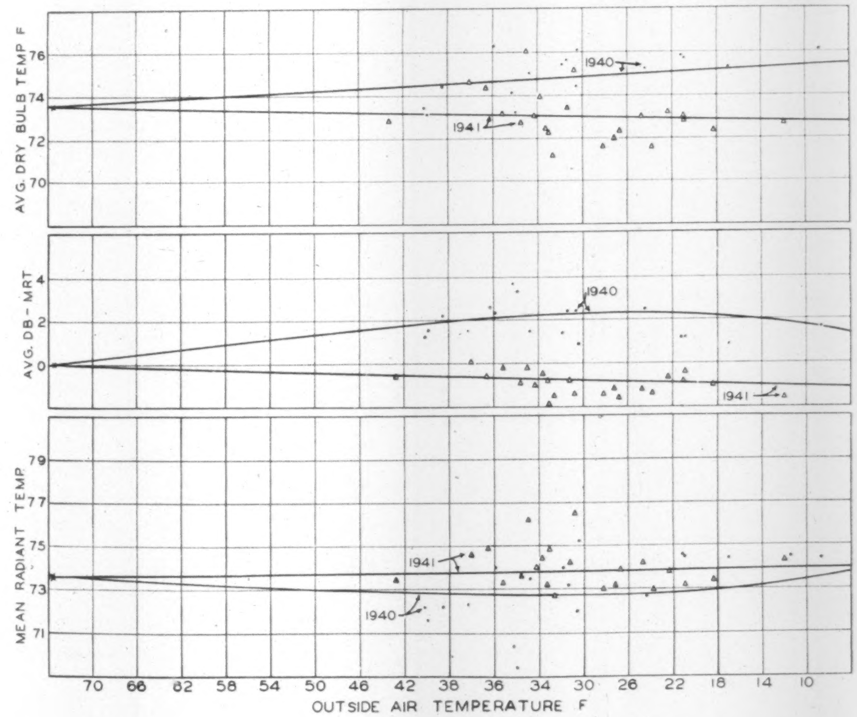

Fig. 9—Relation between OS dry-bulb and MRT, dry-bulb MRT and dry-bulb for panel room

Figs. 10 and 11 give the relation between the outside temperature and the effective temperature required at the 30 in. control point for the two rooms. While in the convection room, a progressively higher effective temperature was required for comfort with lowered outside dry-bulb temperature, in the panel room there was a tendency to compensate so that relatively little elevation in the effective temperature is indicated for cold outside temperatures, even compared with the single control point at 68 deg ET when radiation was not a factor.

While the purpose of this investigation was essentially to study the effect of radiation on the feeling of warmth, as compared with the temperature, moisture content and velocity of the air, and while the types of heating systems used were essentially to give variation in the radiation effect, the great interest in these respective systems made it desirable to attempt to get some figures on the relative heating requirement for the three. Last year's investigation showed that on the average the radiator system required approximately 10 per cent more heat to maintain comfort than was the case in the convection system.

Fig. 12 shows the relation between the electric heating requirements of the panel and convection rooms. The location of the panel in the ceiling, and the requirement that insulation be placed above it in order to conserve heat, made it desirable to also insulate the ceiling of the convection room in order to give a better comparison. Nicholls' heat flow meters placed on top of the insulation above the ceiling in both rooms made it possible to evaluate the heat escaping through the ceiling in the two instances. In order to make the comparisons of the actual heat requirements within the rooms themselves comparable, the ceiling loss was deducted from the heat supplied to each room. Since most of the tests in this year's study were made with elevating temperature throughout the test period considerable heat was stored within the panel-ceiling assembly and in the panel heating system during the test. As pointed out above, it was possible to integrate the temperature rise—heat capacity relationship for the entire assembly with some degree of accuracy. This made it possible in Fig. 12 to correct the heat supplied to the panel room for the storage in the panel and the ceiling loss for that room and for the ceiling loss for the convection room, and thereby to offer a comparison of what is here termed the *useful heat input* for the two rooms. This shows an increase of about 11 per cent in the average case for the panel room.

The reason for the increase in heating requirement with the increase in the mean radiant temperature is apparent. The radiation from the warm panel surface raises the temperature of all surfaces in view of it, including the inside surfaces of all outside walls (including the glass) resulting in an increase in the heat transfer to the outside. It is therefore apparent that any system which elevates the mean radiant temperature will have an increased heat loss if other factors remain the same.

The temperature gradient from the ceiling to the floor in the panel and convection rooms for this year's study, and for the radiation room in last year's study are given in Fig. 13. Curves are drawn for the average of all tests for each room at the time when the subjects were comfortable. The temperature was controlled at the 30 in. level; hence the small variation in the level of the curves at this elevation. The small difference results from the variation in the dry-bulb temperature at comfort with the different heating methods.

It is of interest to note the higher floor surface temperature in the panel room resulting from the absorption of radiant heat as compared with that for the convection room. This should serve to give some comfort advantage for this method of heating. The higher temperature of the air approaching the panel and the lower temperature near the ceiling of the convection room are no doubt important factors in the greater heat loss shown for the panel room. The area between the panel room and the convection room curves between the floor and the approximately 4 ft level is important in the feeling of warmth for the seated person and is a measure of counteracting effect of the greater mean radiant temperature in the panel room.

Discussion of Results of the Study

The paper serves in general to verify the results of last year's study as regards the relationship between the effect of mean radiant temperature, and the effective temperature of the air in determining a person's feeling of warmth. While slightly higher effective temperatures are indicated by the data plotted in Fig. 6, the same slope of the curves is indicated for the two studies. As determined by these curves a 1 deg ET fall is compensated for by a 3.13 deg elevation in the mean radiant temperature, or a 1 deg elevation in the mean radiant temperature is compensated for by a 0.32 deg ET depression. These curves as drawn from the data show some contrast with the results of the analysis of Bedford's work as contained in the last report[3] and shown by a curve in Fig. 7, where an elevation of 1 deg in the mean radiant temperature is compensated for by a depression of 0.57 deg ET.

The data in Table 1 show that an average change of 2.9 deg ET was required to change the feeling of warmth from ideally comfortable to either comfortably warm or comfortably cool. It would follow, therefore, that a change of 9.1 deg in the mean radiant temperature would be required to change the feeling of warmth from ideally comfortable to comfortably warm or comfortably cool with no other change in the environmental condition. The data plotted for both studies in Fig. 7 show an extreme range of approximately 8 deg in the difference between the dry-bulb temperature and the mean radiant temperature for all tests in both years' study. In other words, if no other environmental conditions than the mean radiant temperature had been changed in any test for the three

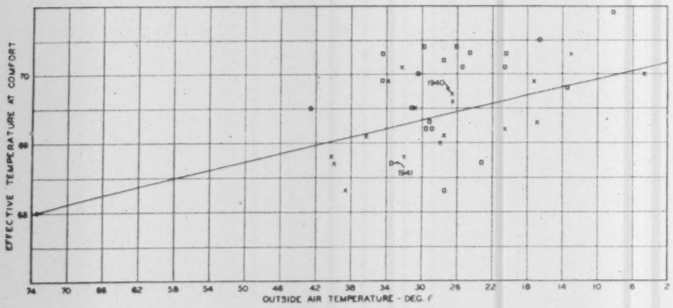

Fig. 10—Relation between Effective Temperature at which comfort was realized and concurrent outside air temperature for convection room

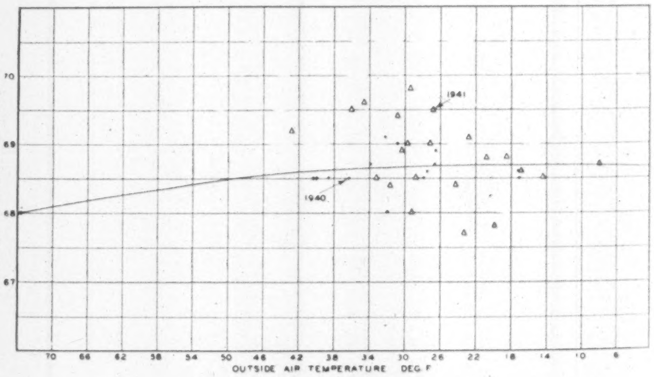

Fig. 11—Relation between Effective Temperature at which comfort was realized and concurrent outside air temperature for panel room

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[3] Loc. Cit. Note 2.

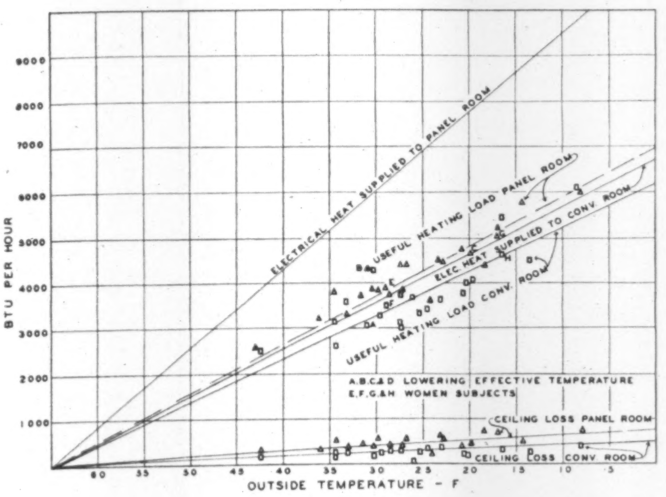

Fig. 12—Electrical heat supplied to heating units, heat loss through ceiling, heat stored in water system and panel room and the resulting useful heating load for the convection and panel heated rooms

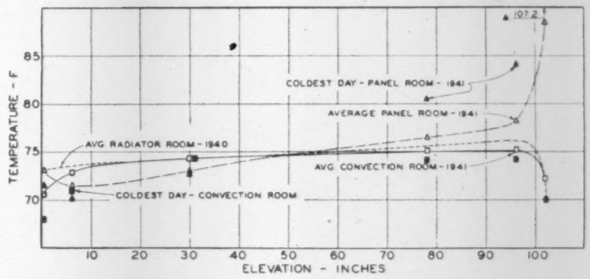

Fig. 13—Ceiling to floor temperature gradient for average of all 1831 tests in the panel and convection rooms with test points for the coldest day test 17, 8 F min, also average of all 1940 tests in radiator room. Temperatures at 0 in. and 102 in. are floor and ceiling surfaces

types of systems studied, the maximum effect of the mean radiant temperature change would have been only sufficient to change the feeling of warmth by as much as from ideally comfortable to comfortably warm or comfortably cool. Thus, it will be seen that the three methods of heating involving widely different ratios of radiated and convected heat additions to the enclosures gave relatively little difference in the feeling of warmth experienced by the occupants.

The fact that the mean radiant temperature was not successfully elevated by the panel system by more than 2 deg above the dry-bulb temperature in any test is of interest. However, it should be emphasized that the current study represented a single and preliminary attempt to elevate the mean radiant temperature by the use of panel heating, and that the possibility of further elevating it was by no means exhausted. The panel used was large, and it was therefore not possible to heat its surface to a very high temperature without overheating the room. This was pre-arranged as a desirable feature; however, it may be possible that the mean radiant temperature could be more easily elevated by a smaller panel area and a greatly increased panel surface temperature. The accepted opinion on this point is controversial. Nevertheless, if this study is not conclusive on the success of greatly elevating the mean radiant temperature by panel heating, it at least serves a useful purpose in this direction, and further studies along this line should be helpful.

In this connection it may be well to point out the fact that reports in the literature of instances where extremely low dry-bulb temperatures were found to be comfortable with greatly elevated mean radiant temperatures do not at all simulate building heating practice. In some instances[4] the space heated was an outside porch arrangement, or a room without a side wall, and in other instances[5] excessive ventilation rates of cool air were supplied in order to make the exaggerated effect possible.

While the study seems to indicate that sufficient information is available to properly evaluate the effect of radiation in the feeling of warmth within the zone of comfort, further work must be done before this environmental factor can be completely evaluated in the effective temperature index to the same extent that the other three environmental factors are: namely, dry-bulb temperature, moisture content and air movement. It must be admitted that there will arise many instances where the mean radiant temperature is elevated far above that indicated in this study, and if such cases are construed as being economically important, then this phase of the subject should be extended to include higher mean radiant temperatures.

The present growing interest in panel heating and the indication that it is rapidly becoming of economic importance as a method of heat application, together with the experience gained in this study, emphasizes the importance of further fundamental studies of such basic factors in panel heating as the relative effect of panel size and panel surface temperature on the mean radiant temperature which may be obtained in different types of rooms. This relationship will undoubtedly be affected by such factors as the relation between heat loss by wall transmission and by ventilation and either controlled or uncontrolled infiltration.

Further study should be made of the effect of such factors as the shape, location, and temperature distribution of the panel surface, the method of applying the heat to its interior, the heat emission per square foot of panel, the allowable panel surface temperatures without adversely affecting the comfort of occupants when the panel is in the floor, side wall, or ceiling, and the effects of the panel heat capacity on the temperature control of the enclosure.

While the relatively high heat capacity of panel-ceiling assembly and heating system was found to adversely affect the desired control over temperature conditions within the panel-heated room used in this study, as previously mentioned, it should be emphasized that those disadvantages pertained largely to the experimental character of this study, and that they may not at all apply as important factors in the practical problem of space heating. In this study it was desired to change the temperature of the air up and down at will, while in heating practice the reverse is usually desired, namely, temperature stabilization.

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[4] Room Warming by Radiation, by A. H. Barker. (ASHVE TRANSACTIONS, Vol. 38, 1932.)

[5] Obtaining Comfort Conditions by Controlled Radiation from Electrically Heated Walls, by L. W. Schad. (*AIEE Transactions*, 1933, Vol. 52).

Philadelphia Host for the 48th Annual Meeting

Philadelphia Art Museum, Benjamin Franklin Parkway

THE program for the 48th Annual Meeting of the Society has been completed and members and their friends who spend the week of January 26, 1942 there will find their hosts ready to maintain the traditions of the City of Brotherly Love.

M. F. Blankin, General Chairman of the Committee on Arrangements announces a varied technical program with morning sessions at the hotel headquarters, Bellevue-Stratford at Walnut and Broad Streets and afternoon sessions in the Ballroom at the Exposition at 34th St. near Spruce. A series of attractive social functions has been provided and a fine program for the ladies has been planned. Full details will be found on the following page.

Registration will commence on Sunday, January 25 in the Planet Room, the Society's headquarters at the Bellevue-Stratford. The Council will hold its meeting in the morning and in the afternoon the Committee on Research will meet.

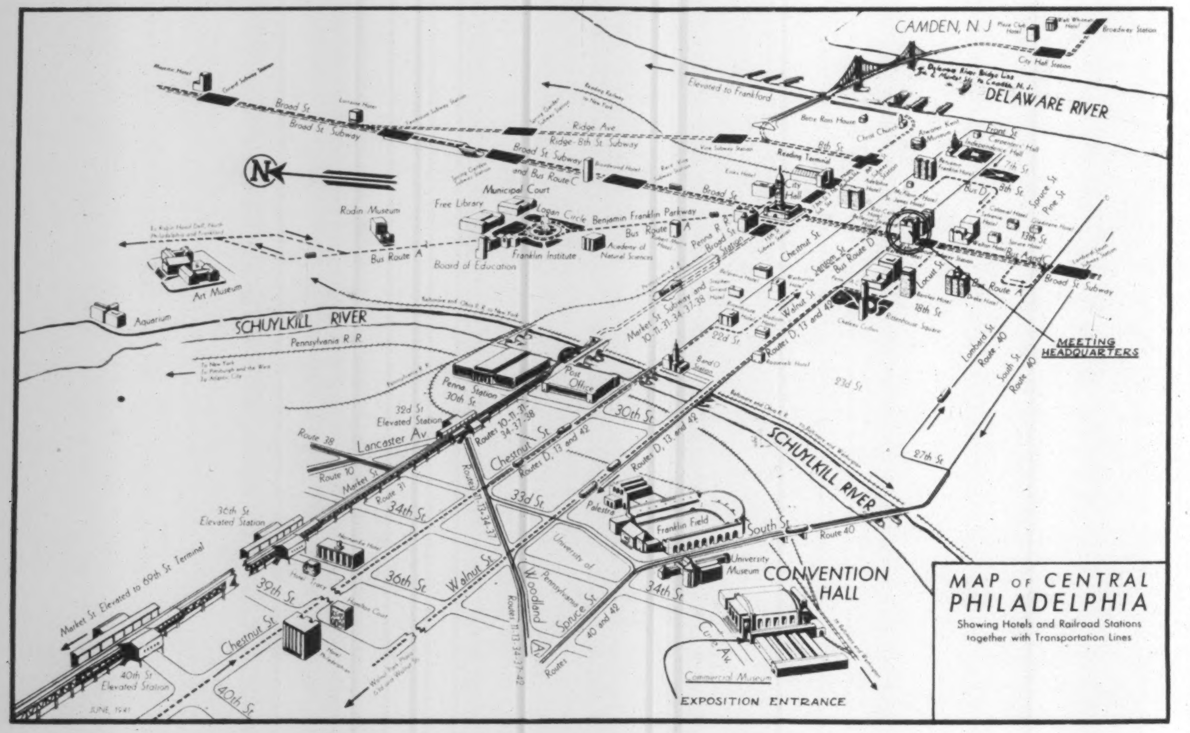
At 9:30 on Monday morning, January 26 there will be a business session in the Rose Room of the Bellevue-Stratford for ASHVE members only; at 12:30 a Get-Together Luncheon will be held at the Commercial Museum restaurant adjacent to the 7th International Heating and Ventilating Exposition which opens at 2:00 p. m. and will continue until Friday, January 30.

Seven technical sessions have been scheduled and there will be a joint session on Wednesday afternoon with the members of the *National Warm Air Heating and Air Conditioning Association.*

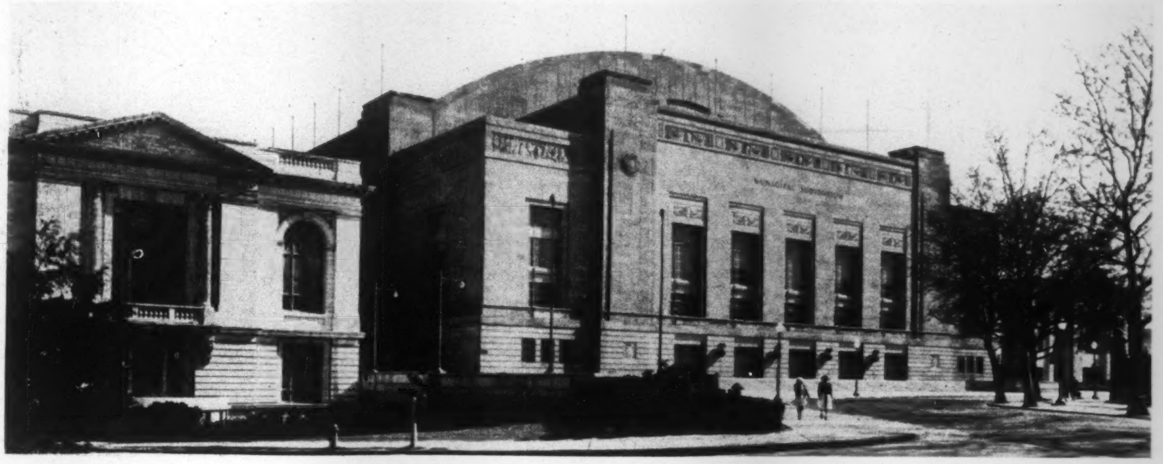
Some of the nation's most historic shrines are located in Philadelphia and the accompanying map shows their locations, as well as important public buildings, hotels and railroad stations. There will be an opportunity to visit Franklin Institute, the Wonderland of Science and the Fels Planetarium. Other attractions are the Museum of Art, the Rodin Museum and the Aquarium. Adjacent to the Heating and Ventilating Exposition are the exhibits in the Commercial Museum from Latin America, Africa, China, Japan and many other countries. Nearby is the University Museum containing comprehensive collections of Egyptian and Oriental antiques as well as exhibits of Chinese, African and American Indian Art.

On Friday several inspection trips are planned and members should register their choice at the hotel headquarters.

Heating, ventilating and air conditioning will be the chief topic of conversation in Philadelphia during the week of January 26 with the combined attractions of the Society's 48th Annual Meeting at the Bellevue - Stratford, 28th Meeting of the *National Warm Air Heating and Air Conditioning Association* at the Benjamin Franklin and the Heating and Ventilating Exposition in the Commercial Museum.


CAMDEN, N. J
Broadway Station
City Hall Station
Delaware River Bridge Line 5th & Market Sts to Camden, N.J.
DELAWARE RIVER
Elevated to Frankford
Betsy Ross House
Christ Church
Front St
Carpenters' Hall
Independence Hall
7th St
8th St
Reading Terminal
City Hall
Broad St
Broad St Subway
Ridge Ave
Ridge-8th St Subway
Broad St Subway and Bus Route C
Municipal Court
Free Library
Logan Circle
Benjamin Franklin Parkway
Bus Route A
Rodin Museum
Franklin Institute
Board of Education
Academy of Natural Sciences
Art Museum
Aquarium
SCHUYLKILL RIVER
Pennsylvania R R
Penna Station 30th St
Post Office
32d St Elevated Station
Lancaster Av
Route 38
Route 10
Market St
Route 31
Chestnut St
Routes D, 13 and 42
Sansom St
Bus Route D
Walnut St
Locust St
Spruce St
Pine St
13th St
18th St
Rittenhouse Square
22d St
23d St
27th St
Lombard St
Route 40
South St
MEETING HEADQUARTERS
30th St
33d St
34th St
36th St
39th St
40th St
Palestra
Franklin Field
University Museum
CONVENTION HALL
Commercial Museum
EXPOSITION ENTRANCE
36th St Elevated Station
40th St Elevated Station
Market St Elevated to 69th St Terminal
Woodland
University of Pennsylvania
JUNE, 1941

MAP OF CENTRAL PHILADELPHIA
Showing Hotels and Railroad Stations together with Transportation Lines



Commercial Museum and Municipal Auditorium

PROGRAM

48th Annual Meeting

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

The Bellevue-Stratford, Philadelphia, Pa.

January 25-29, 1942

Sunday, January 25

9:00 a.m. REGISTRATION *(Planet Room*—Bellevue-Stratford)

10:00 a.m. Council Meeting
Committee Meetings

3:00 p.m. Committee on Research

7:45 p.m. Planetarium

Monday, January 26

8:30 a.m. REGISTRATION *(Planet Room*—Lobby Floor—Bellevue-Stratford)

9:30 a.m. Business Session—ASHVE Members only *(Rose Room*—10th Floor—Bellevue-Stratford)
Reports of Officers
Reports of Committees
Report of Tellers
Unfinished Business

12:30 p.m. Get-together Luncheon (Commercial Museum Restaurant)

2:00 p.m. Opening of 7th International Exposition (Commercial Museum—34th St. near Spruce)

2:30 p.m. TECHNICAL SESSION *(Ballroom* at the Exposition)
Panel Heating and Cooling Performance Studies, by B. F. Raber and F. W. Hutchinson
Radiation as a Factor in the Feeling of Warmth in Convection, Radiator and Panel Heated Rooms, by F. C. Houghten, Carl Gutberlet and E. C. Hach.
A New Electrical Method for the Investigation of Periodic Heat Flow in Building Walls, by Victor Paschkis

7:30 p.m. Organization Meeting Committee on Research

9:30 p.m. Variety Show *(Ballroom*—Bellevue-Stratford)

Tuesday, January 27

9:30 a.m. TECHNICAL SESSION *(Rose Room* — 18th Floor—Bellevue-Stratford)
Performance of a Hot-Water Heating System in the Research Home, by A. P. Kratz, M. K. Fahnestock, W. S. Harris and R. J. Martin
A Comparative Study of the Friction-Heads in Screwed and Welded Elbows, by F. E. Giesecke and J. S. Hopper
Some Factors Influencing the Heat Output of Household Radiators, by A. C. Davis, W. N. Sawdon and David Dropkin

12:00 noon Exposition (Commercial Museum)

2:00 p.m. TECHNICAL SESSION *(Ballroom* at the Exposition)
Entrainment and Jet-Pump Action of Air Streams, by G. L. Tuve, G. B. Priester and D. K. Wright, Jr.
Development and Application of a Method for Determining Sound Attenuation in Air Conditioning Systems, by D. A. Wilbur and R. F. Simons
The Performance of Stack Heads Equipped with Grilles, by D. W. Nelson, D. H. Lamb and G. E. Smedberg

9:30 p.m. An Evening of Magic—Paul F. Fleming & Company *(Ballroom*—Bellevue-Stratford)

Wednesday, January 28

9:30 a.m. TECHNICAL SESSION *(Rose Room*—18th Floor—Bellevue-Stratford)
The Vapor Pressure of Ice, by John A. Goff
Reactions of Individuals Working in High Temperatures, by M. B. Ferderber, M.D.
Physiological Influence of Atmospheric Humidity, by Technical Advisory Committee on Physiological Reactions, C.-E. A. Winslow, *Chairman.*
Sanitary Ventilation, by W. F. Wells and Richard Green

12:00 noon Exposition (Commercial Museum)

2:00 p.m. JOINT SESSION with *NWAHACA* *(Ballroom* at the Exposition)
Pressure Loss Caused by Elbows in 8-Inch Round Ventilating Duct, by M. C. Stuart, C. F. Warner and W. C. Roberts
Performance of Experimental Chimney Sizes, by R. S. Dill
Heat Loss Through Basement Walls and Floors, by F. C. Houghten, S. I. Taimuty, Carl Gutberlet and C. L. Brown

7:00 p.m. Annual Banquet *(Ballroom*—Bellevue-Stratford)

Thursday, January 29

10:00 a.m. TECHNICAL SESSION (*Rose Room* — 18th Floor Bellevue-Stratford)

Comfort with Summer Air Conditioning, by Technical Advisory Committee on Sensations of Comfort, Thomas Chester, *Chairman*

The Effect of Attic Fan Operation on the Cooling of a Structure, by W. A. Hinton and Albert F. Poor

Heat Gain Through Walls and Roofs as Affected by Solar Radiation, by F. C. Houghten, E. C. Hach, S. I. Taimuty and Carl Gutberlet

Installation of Officers

12:00 noon Exposition (Commercial Museum)

12:30 p.m. Organization Meeting of Council

2:00 p.m. TECHNICAL SESSION (*Ballroom* at the Exposition)

Use of Cold Accumulators in the Air Conditioning Field, by R. W. Evans and C. J. Otterholm

The Design and Performance of a Direct-Fired Unit Heater, by R. M. Rush and H. A. Pietsch

Corrosion Tests in a Water-Recirculating Air Conditioning System, by W. Z. Friend

Adjournment

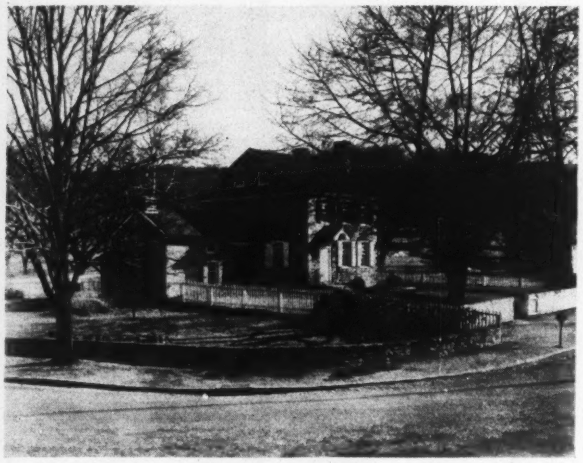
SPECIAL EVENTS FOR LADIES

Sunday

7:45 p.m. Leave Bellevue-Stratford for Planetarium

Monday

3:30 p.m. Tea and Musical Entertainment



Washington's Headquarters, Valley Forge, Pa.

Tuesday

10:30 a.m. Sightseeing trips to Historic Spots in Philadelphia and Luncheon at General Wayne Inn, Valley Forge

Wednesday

1:00 p.m. Luncheon and Fashion Show (*Burgundy Room*—Main Floor—Bellevue-Stratford)

Thursday

10:45 a.m. Breakfast-Bridge (Assemble in *Planet Room*—Lobby Floor—Bellevue-Stratford)

Franklin Institute and Art Museum

7th Exposition

Judging from the plans submitted by the 275 exhibitors who have contracted for space at the 7th International Heating and Ventilating Exposition, this will be the most artistic and elaborate in the series of shows that have been held biennially since 1930. Already 80 per cent of the available space in the main exposition hall of the Commercial Museum, 34th near Spruce St., has been reserved and many of the manufacturers will have operating exhibits to demonstrate their equipment. The majority of those who are displaying oil burners and stokers will operate their units.

Exhibitors will stress the importance of greater efficiency of operation with a view to lower costs and fuel conservation. The necessity for improved working conditions in industries engaged in national defense operations gives special significance to the 7th International Heating and Ventilating Exposition.

The manufacturers of all types of units for heating, ventilating, air conditioning service will have their most advanced models on display and these will include air cleaning equipment, cooling and conditioning units, fans and blowers, boilers and furnaces, instruments, insulating materials, control and regulating equipment, grilles and registers, heating systems and accessories, motors, pumps, refrigerating machinery, temperature control systems, traps, valves, water treatment apparatus, and the innumerable other devices needed for the complete heating, ventilating and air conditioning of all types of buildings.

It is evident that the new equipment to be shown will cover all branches of the field and will reveal how adjustments are being made by manufacturers in adapting their production to national defense needs. Industrial mobilization for defense has created many new problems and the exhibitors will emphasize how vital their products are to civilian and defense housing, factories, barracks and ship building applications.

Conservation of fuel will be the theme of many exhibitors and new applications to air conditioning for black-out plants will show how quality of product and speed of manufacture will be influenced in controlled atmosphere and at the same time provide an effective and stimulating environment for workers.

The big show begins at 2 p. m., January 26 and will be open daily thereafter until January 30, from 12 noon until 10:30 p. m.

ALL ABOARD!
for

PHILADELPHIA

PRESIDENT FLEISHER ON PRINCETON BOARD

Pres. Walter L. Fleisher has been notified by Dr. H. W. Dodds, president of Princeton University, Princeton, N. J., that he was recently elected by the University Board of Trustees to serve for a two-year term on the Advisory Council of the Department of Mechanical Engineering.

DELTA OPENS SEASON

November 6, 1941. A regular meeting of the Delta Chapter was held in New Orleans, La., with 19 members and guests attending and Pres. C. B. Gamble presiding. The minutes of a luncheon meeting held in October were read and adopted.

G. E. May, chairman of the program committee, advised that the Board of Commissioners of the Port of New Orleans had invited the members to participate in a boat trip through the Industrial Canal and the invitation was unanimously accepted.

F. G. Burns, former secretary of the chapter, was called to serve in the U. S. Army and L. V. Cressy was nominated and elected to succeed him in that capacity.

A motion was made and carried to form a permanent committee to assist the secretary in increasing the attendance at the regular meetings and the following are serving on the committee: Messrs. J. S. Adair, W. H. Dudley, Jr., J. J. Friedler, Jr., O. E. Gammill, R. B. Guest, J. J. Joyce and F. J. Kelley.

Mr. Cressy was unanimously elected as delegate for the 1942 Annual Meeting in Philadelphia and Mr. Adair was elected as his alternate.

President Gamble then introduced J. M. Guillory of the New Orleans Public Service, Inc., who gave a very interesting talk on the relation of lighting and air conditioning. He traced the history of light to the present time and gave some facts on the relation of air conditioning to fluorescent lighting. Following Mr. Guillory's presentation, questions were asked and very ably answered by the speaker.

Mr. May then gave a description of the method used to ventilate the 1500-watt lamps used to illuminate the first floor of the New Orleans Public Service, Inc., following which the meeting adjourned at 10:00 p.m.

OPM REPRESENTATIVE ADDRESSES WESTERN NEW YORK

November 10, 1941. The second meeting of the 1941-42 season for the Western New York Chapter was held at the University Club, Buffalo, and the minutes of the previous meeting were read and approved.

The secretary read a letter from V. J. Jenkinson, secretary of the Ontario Chapter, in which it was suggested that the March meeting would be desirable for the joint meeting, which has had considerable discussion.

B. C. Candee submitted a report of the treasurer which was read and approved and transmitted to the secretary to be made a part of the minutes. In this connection Joseph Davis announced that he still was in possession of a sum of money which was left over from last year's Christmas party and he proposed to turn this in to be added to the credit of the Society.

Following several motions made by Mr. Candee, Pres. W. R. Heath appointed Joseph Davis as chairman of the committee to arrange for this year's holiday party, and S. W. Strouse and D. J. Mahoney as his assistants.

C. W. Farrar discussed the possibilities of having the 1944 Annual Meeting in Buffalo and President Heath requested Mr. Farrar to arrange a meeting to discuss this subject.

Secretary Seelbach then read a letter from the Office of Production Management in which the personnel branch outlined the qualifications required and the type of jobs open to members of the Society in the OPM set-up.

L. P. Saunders then reported on his meeting with the Ontario Chapter group and their pleasure at the prospect of a joint meeting with the Buffalo Chapter.

Mr. Davis requested that the Chapter give consideration to the possibility of holding a formal dance some time during the beginning of 1942, and also requested that the President appoint a committee to arrange such an affair.

Mr. Farrar suggested that, in accordance with past practice, a group photograph of the members of the chapter be taken at the Christmas party and he volunteered to make arrangements to have this done.

President Heath then introduced the guest of the evening, Paul R. Smith, Buffalo district manager for the Priority Field Service, Office of Production Management, whose subject was *Priorities and Defense*. Mr. Smith gave a very interesting and instructive talk on this subject and clarified many of the troublesome aspects of the priority set-up. At the conclusion of his remarks the meeting was thrown open to discussion and a number of the members brought up questions which Mr. Smith answered very satisfactorily.

As reported by Secretary Seelbach, this discussion period conducted by Mr. Smith was one of the most interesting talks the Buffalo Chapter has heard in many meetings. A rising vote of thanks was given to Mr. Smith, and the meeting adjourned.

Oklahoma Chapter Officers 1941-1942

A. R. Morin
President

J. H. Carnahan
Secretary-Treasurer

E. F. Dawson
Board of Governors

S. L. Rolland
Board of Governors

ONTARIO HEARS DR. HOUGHTEN

November 3, 1941. Fifty-two members and guests of the Ontario Chapter gathered at the Royal York Hotel, Toronto, for the November meeting, at which Pres. C. Tasker presided. Following dinner President Tasker called upon V. J. Jenkinson who outlined the program for the coming year as follows:

December—Morley C. Lazier will speak on the Engineers' Place in the World.

January—Will be Old Timer's Nite. It is intended to have some of the older members speak on the developments of heating, ventilating and air conditioning in the last few years.

February—Will be in the form of a visit to a local industrial plant.

March—Will be a joint meeting with the Western New York Chapter and will be held at Niagara Falls, Ontario.

President Tasker then introduced Dr. F. C. Houghten, who spoke on the activities of the Society's research program and the investigations under way with the cooperative institutions. The members enjoyed Dr. Houghten's presentation and at the conclusion H. H. Angus expressed a vote of thanks to Dr. Houghten for his splendid address.

L. P. Saunders, Lockport, N. Y., a member of the Society's Council, spoke briefly and extended greetings from the Western New York Chapter.

O. L. Maddux, New York, N. Y., also brought greetings from the New York Chapter. Following remarks by Mr. Maddux, President Tasker announced that the Chapter would select a delegate to attend the Society's 48th Annual Meeting to be held in Philadelphia in January, and the meeting was adjourned.

FBI REPRESENTATIVE AT ST. LOUIS MEETING

November 4, 1941. The regular St. Louis Chapter meeting was held at the DeSoto Hotel, St. Louis, with Pres. D. J. Fagin presiding. Secretary Carter read the minutes of the previous meeting, which were approved as read and E. H. Ronsick, chairman of the attendance committee reported 40 members and guests present. Mr. Ronsick then introduced the new members and guests, including A. V. Hutchinson, secretary of the Society.

Mr. Hutchinson addressed the meeting calling attention to The Guide which will be issued in 1942. He told of the desire of an English member, now in a German prison camp, who is trying to get a copy of The Guide to assist him in conducting classes among his fellow prisoners of war. He mentioned that the dues and admission fees were unchanged for 1942.

L. Walter Moon recalled that Capt. J. K. M. Pryke attended the Annual Meeting in St. Louis and that he was one of his sponsors.

Following the report of the treasurer and announcements by President Fagin, B. C. Simons reported that the December meeting would be addressed by John Knighton, Evansville, Ind., on the subject of a gas-fired year-round air conditioning unit.

Mr. Simons then introduced H. W. McLarney, who presented an able analysis of the subject of use of cold accumulators in the air conditioning field. Mr. McLarney mentioned local experiences with such storage systems, and reviewed some of the research reports issued during the past 10 years. He was critical of the apparent lack of safety factor in the calculations in the paper under discussion and pointed out that a shortage of capacity in this type of system will result in total lack of cooling effect in the final hours of use, rather than in an inadequacy during peak hours as in a direct expansion system. Comments were made by Messrs. Boester, Carter and Norris, all of St. Louis. After a brief recess, Mr. Simons introduced A. G. Gilliland, special agent attached to the St. Louis office of the Federal Bureau of Investigation. Mr. Gilliland spoke on the subject *Mechanical Devices Used in Crime Detection.* He first traced the history of the FBI, which was founded in 1908, and reorganized in 1924 under the direction of Harlan F. Stone (now Chief Justice of the Supreme Court), then attorney-general. The director of the FBI appointed in 1924 was J. Edgar Hoover.

He further explained that the FBI is staffed principally by lawyers, accountants and engineers, with the latter, together with researchers in science, specializing in the work of the laboratory, established in 1934. In September 1939 the FBI was designated by the President as the central agency to investigate espionage and sabotage.

Mr. Gilliland described the cooperation and facilities offered by the FBI and its research laboratory to local law enforcement agencies. Such skilled detection and laboratory assistance are available without charge or expense, in any legitimate criminal trial, but are not available in civil cases.

The speaker described case histories in which the FBI helped solve various crimes which would have remained practically insoluble without its scientific resources. Such facilities include: the comparison microscope; heat or chemical treatments to restore effaced motor numbers; many types of microscopes used with photographs for tangible evidence; identification of paper, watermarks, etc.; the spectrograph, and with it the *densitometer comparator* used in analyzing spectra of metals and other substances under examination of documents for secret writing; and the files on known spies and criminals.

There was a great deal of interest shown in Mr. Gilliland's presentation and the members and guests submitted many questions which were answered by the speaker.

The Chapter expressed their thanks to Mr. Gilliland by a rising vote for his instructive talk, and the meeting adjourned at 9:30 p. m.

FALL MEETING AT NORTH CAROLINA

October 10, 1941. The Fall meeting of the North Carolina Chapter was held at the Sedgefield Inn, Greensboro, N. C., with 32 members and guests in attendance.

During the afternoon a number of the members enjoyed from 9 to 18 holes of golf on the attractive Sedgefield course, following which was the usual get together at dinner.

After dinner Harry Hoffman introduced J. Vernon Ruzicka, Greensboro, who put the audience into a pleasant frame of mind with a short humorous discourse.

John James, New York, N. Y., technical secretary of the ASHVE, the principal speaker, was then introduced. Mr. James discussed the history of the ASHVE Research Laboratory at Pittsburgh, the investigations being carried on in cooperation with the various institutions, and outlined the trend of research to come in the near future. He very ably portrayed the function of the Society's research program, showing its great value to the membership. Mr. James satisfied everyone present that the appropriations for research are being ably handled.

Following Mr. James' talk a short business meeting was held, after which the meeting adjourned.

WESTERN MICHIGAN MEMBERS MEET AT GRAND RAPIDS

October 14, 1941. The October meeting of the Western Michigan Chapter was held at the Rowe Hotel, Grand Rapids, with 43 members and guests in attendance. The meeting was called to order by Pres. W. G. Schlichting, and the minutes of the annual May meeting were read and approved.

President Schlichting outlined the activities for the coming season and named the following committee chairmen: *Code,* W. W. Bradfield; *Entertainment,* O. D. Marshall; *Membership,* H. D. Bratt; *Program,* F. C. Warren; and *Publicity-Attendance,* T. D. Stafford. He then informed each chairman that he expected a report of the progress of his committee each month.

Prof. L. G. Miller reported on his trip to the San Francisco meeting of the Society and announced the nomination of S. H. Downs for the office of second vice-president.

It was announced that the next meeting would be held in Kalamazoo and President Schlichting then turned the meeting over to Vice President Warren who introduced the speaker of the evening, Dr. F. C. Houghten, director of the Society's Research Laboratory at Pittsburgh. Dr. Houghten gave a very interesting talk on ASHVE Research which was thoroughly enjoyed. Following the discussion President Schlichting declared the meeting adjourned with a closing message to the members to attend all meetings.

JOHN JAMES VISITS MASSACHUSETTS

October 21, 1941. The regular October meeting of the Massachusetts Chapter was held at the Massachusetts Institute of Technology, Cambridge, and 40 members and guests attended.

Pres. J. W. Brinton called the meeting to order and announced that the State Bill for licensing engineers had been signed by the Governor. He then recommended that all engineers participate in the civilian defense program by reporting to the Chief in their home areas.

Following a report by the treasurer, D. J. Edwards introduced John James, Technical Secretary of the ASHVE, who gave a very interesting review of the many research activities which the Society is sponsoring. He used slides to show clearly the vast extent of these researches both geographically and technically. After a lively discussion, in which Mr. James was kept busy answering questions, a rising vote of thanks was extended to him for his fine presentation.

W. H. Driscoll was announced as the speaker at the November meeting, and according to Secy. E. G. Carrier's report the meeting adjourned at 9:45 p. m.

GOLDEN GATE WELCOMES DR. GIESECKE

October 7, 1941. The monthly meeting of the Golden Gate Chapter of the Society was held at the Engineers Club, San Francisco, with Dr. F. E. Giesecke, College Station, Tex., as the guest of the evening. Pres. Clyde Bentley opened the meeting and the minutes of the September meeting were approved as submitted. The members and guests numbered 29.

J. A. Hill introduced the speaker, Dr. Giesecke, who is Past President of the ASHVE and Professor Emeritus at the Texas A. and M. College. Dr. Giesecke gave a splendid talk on the subject *Research Activities of the Society,* and emphasized the work done in the studies on hot water heating at Texas A. and M. He supplemented his talk by a large number of slides showing various test apparatus used in the research studies of the Society, as well as charts and curves developed at the College on the flow resistance in hot water heating systems. Dr. Giesecke's message on the value of research and the necessity of the research activities in the ASHVE was a challenge to the Golden Gate Chapter to make every effort to enlarge its membership, thereby increasing contributions for this worthwhile work.

As evidenced in Secretary Kooistra's report, the members enjoyed meeting Dr. Giesecke again, who, they stated, is still a great promoter of research activity for the Society. His nephew, Walter Giesecke, who is located in San Francisco, attended the meeting as a guest of the chapter. The meeting adjourned at 9:15 p. m.

NATIONAL DEFENSE DISCUSSED AT WASHINGTON, D. C.

October 13, 1941. The first regular meeting of the Washington, D. C. Chapter was held at Normandy Farm, Potomac, Md., with 75 members and guests in attendance.

Pres. F. A. Leser, after a brief word of welcome, introduced T. H. Urdahl, who acted as toastmaster. During dinner Mr. Urdahl presented W. L. Fleisher, president of the Society, M. F. Blankin, treasurer, and A. V. Hutchinson, secretary. Dr. F. E. Giesecke, past president of the ASHVE, was also presented along with members of the Council, the Messrs. L. P. Saunders, S. H. Downs, A. J. Offner, E. N. McDonnell, Prof. G. L. Tuve, J. F. S. Collins, Jr., Prof. A. P. Kratz, W. A. Russell, and C. Tasker.

Following dinner C. C. Dawson, National Resources Planning Board of the U. S. Civil Service Commission, spoke on the topic *Wanted—Engineers for National Defense.* Mr. Dawson explained how heating and ventilating engineers were being used in other capacities because of their versatility. He stressed the need for engineers in the National Defense work.

Following Mr. Dawson's talk, A. W. Volkmer of the Civil Service Commission made an appeal for applicants to file their papers for governmental employment at the earliest possible moment.

Commander Urdahl then introduced F. J. Trecker who, as Chief of the Sub-Contracting Division, Contract Distribution O.P.M., delivered an authoritative talk on *Contracts vs. Priorities*. Mr. Trecker invited those who had specific questions or problems to confer with him after the meeting.

Pres. W. L. Fleisher spoke briefly on the activity of the ASHVE in National Defense, citing several little known activities of the Society and their contribution to the defense program, and gave examples of how the work of the Research Committee of the Society has been utilized in the present emergency. The meeting adjourned at 10:30 p. m.

SOCIETY RESEARCH HIGHLIGHTED IN ATLANTA

October 8, 1941. The second regular fall meeting of the Atlanta Chapter was held at the Atlanta Biltmore Hotel, and was called to order by Pres. S. W. Boyd, with 37 members and guests present. The minutes of the previous meeting were read and approved.

Reports were submitted by the various committee chairmen, and then President Boyd read a letter from the headquarters office advising that Prof. J. C. Brown of the University System of Georgia would like to receive old copies of the Society's JOURNAL for the students' use who are studying in the field of heating, ventilating and air conditioning. President Boyd requested that the members endeavor to save their old copies of the JOURNAL and it was suggested that they be left with L. F. Kent, who will turn them over to Professor Brown.

President Boyd then introduced the speaker of the evening, John James, technical secretary of the ASHVE. Mr. James began his talk by giving a resumé of the history of the Society's research endeavors pointing out that the Research Laboratory in Pittsburgh started its work in 1919 and since that time the Society has spent approximately three-quarters of a million dollars in research work. Mr. James further brought out that in 1940 the Society sponsored research projects in 13 cooperating institutions to which the Society gave $10,000.00 to further this work. These 13 institutions added an additional $30,000.00 to this work and in that same year the Laboratory spent $40,000.00 to carry on its research program, making a total of $80,000.00 spent in 1940 under the auspices of the Society on its research work.

With the aid of slides, Mr. James then described the research projects that are now being carried on by the Research Laboratory and cooperating institutions in order to obtain three basic types of information for the membership as follows: (1) To set up reliable standards; (2) To obtain fundamental engineering data for use in calculations; (3) To get more reliable information on basic physical laws. In addition to describing various research projects now under way, Mr. James explained why these projects have been undertaken and what the results of these tests will mean from a practical standpoint.

Following his talk, Mr. James answered numerous questions asked by the members and guests and several members complimented the Society's Committee on Research on the splendid research program that is being carried on at the present time.

At the suggestion of T. T. Tucker, the Chapter gave a rising vote of thanks to Mr. James for the thorough and interesting manner in which he presented the Society's research program.

There being no further business the meeting adjourned at 10:00 p. m.

HART-BAKER DIES IN SHANGHAI

Word has just been received by the Society that Henry W. Hart-Baker, owner of Hart Engineering, Shanghai, China, died on March 11, 1941. Mr. Hart-Baker was born on March 19, 1881 at Tiverton, Devon, England. He was educated in London by private tutors and at Regent St. Polytechnic, London.

He received his early training in sanitary engineering and central heating under S. Stevens Hellyer of Dent and Hellyer, Ltd., Newcastle St., Strand, London, and had further training under Professor Corfield and Wright Clarke.

He was employed at various places in the United Kingdom from 1898-1912, traveling extensively during that period, and from 1912 to 1915 was engaged in special work in France, Italy and Switzerland. In 1912 he was recommended by Dent and Hellyer as engineer to the Deco Co., Zurich, Switzerland, at which time he designed the entire sanitary and heating equipment at the Hotel Ritz, Paris. Among the installations carried out under his direction are the Middlesex and Royal Westminster Hospitals also in London, Royal Infirmary, Derby, Ranmoor House, Sheffield, Hotels Continental, Negresco and Terminus at Nice, Hotel Continental at Cannes, France, and the Hotel Royal at San Remo, Italy, and various others on the French and Italian Rivieras.

In December 1915 he went to China, where his engineering work in the Far East carried him to Central and North China, Manchuria and Korea. He became associated with Merritt, Ltd. as Director of the company in 1931. In 1935 he established the Hart Engineering Co. While in China he served in the Volunteer Corps organizations of Shanghai, Hankow and Tientsin.

Mr. Hart-Baker joined the Society in 1918 and continued his membership through the most trying conditions of 1937 and 1938 when the Sino-Japanese hostilities brought about drastic changes in living and working conditions. He also held membership in the *Institution of Heating and Ventilating Engineers, Institution of Sanitary Engineers,* and was a Freeman in the *Worshipful Company of Plumbers.* He was also a member in the Masonic, Cercle Sportif Francais, and Shanghai Lawn Bowls Clubs, as well as belonging to the D.G. Lodge of Scottish Freemasonry in North China.

The Officers and Council of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS extend their deepest sympathy to his widow, Mrs. Nancy Hart-Baker, who survives.

FRED ORGAN, NEBRASKA CHAPTER PRESIDENT, DIES

Fred Organ, president of the Nebraska Chapter of the ASHVE, died on November 1, at his home in Omaha, Nebr., at the age of 57. He had been ill for some time. Mr. Organ was born at Lackawack, N. Y., in 1884, and attended grade school at West Point, and High School at Highland Falls, N. Y. As the son of an instructor in engineering and mathematics at West Point he received five years of special tutoring from West Point instructors in engineering, drawing, mathematics and science.

In 1917 he and his family moved to Omaha, where he successfully practiced architecture for the past 25 years. He personally designed all the mechanical work for numerous buildings, some of which are the Masonic Building, Wahoo, Nebr., Lexington St. Bank, Lexington, Nebr., seven First National Bank Buildings, two in Nebraska and five in Kansas, National Bank of Savings, Sabetha, Kans., the Third National Bank, Sedalia, Mo., and the Beatrice auditorium in Beatrice, Nebr.

Besides being a member of the Society, Mr. Organ was a member of the Nebraska Engineering Society, the Engineers' Club of Omaha, the *Nebraska Architects' Association* of which he was program chairman, and the Kiwanis Club.

He joined the Society in 1939 and was an enthusiastic worker in organizing the Nebraska Chapter during 1940. At the organization meeting he was honored by being elected President, and gave a great deal of his time in promoting the growth of the Chapter.

The Society has suffered a great loss and his many friends and associates in the Nebraska Chapter will miss his energy and enthusiasm.

The Officers and Council of the American Society of Heating and Ventilating Engineers extend their sincere sympathy to his son Thomas Organ, Burr, Nebr., and to his sister and brother, who also survive.

DEATH OF THEODORE KIPP

The death of Theodore Kipp, vice-president and managing director of Kipp-Kelly, Ltd., Winnipeg, Man., Canada, has been announced. Mr. Kipp was born on March 19, 1880, and when a few months old came to Peoria where he received his early education in the public schools, later attending the Bradley Polytechnic, Peoria.

He served his apprenticeship in various industries, particularly milling and distilling, with a view to becoming expert in the recovery of industrial by-products.

Mr. Kipp was originally trained under his father as a milling engineer, but devoted a number of years to the distilling industry, where he developed the method which was adopted universally for the recovery of corn oil by means of the dry process, and also a system for recovery of distillery slops which were formerly wasted or fed to cattle.

Since 1906 he had been engaged mostly in a consulting and supervisory capacity in various industrial plants. In 1908 he went to Canada and his activities had largely been confined to that country since that time.

He was chief engineer for a number of years of the Ogilvie Flour Mills Co., Ltd., for whom he designed and built several large plants. In 1913 he organized the engineering and machinery business in Winnipeg, now known as Kipp-Kelly, Ltd., under whose auspices he built many flour and cereal mills, electric lighting and pumping plants in Western Canada.

He extended his activities by organizing various companies of an engineering character. He was president and managing director of the Winnipeg Heating Co., Ltd.; president, Winnipeg Service Co., Ltd.; director, Alberta Wood Preserving Co., Ltd.; vice-president, Canadian Engineering and Construction Co., Ltd.; vice-president, Sullivan-Kipp-Chace Co., Ltd.; director, William Hamilton, Ltd.; vice-president, Canadian Novadel Co., Ltd.; chairman of the New Industries Committee, Industrial Development Board of Manitoba.

Mr. Kipp joined the Society in 1937 and took an active interest in Society affairs. He was also a member of the *Association of Professional Engineers of Manitoba, American Society of Mechanical Engineers, American Chemical Society,* and chairman, Manitoba Branch, *Engineering Institute of Canada.*

During the World War he was consultant to the British Food Board, for whom he designed and built a number of large food plants in England and Ireland.

He was the author of the Hand Book on the Milling Industry.

The Officers and Council of the American Society of Heating and Ventilating Engineers wish to extend their heartfelt sympathy to Mr. Kipp's widow, daughter and two sons, Flight Lt. T. R. Kipp, now a prisoner of war in Germany, and R. A. Kipp, president and managing director of Kipp-Kelly, Ltd.

Candidates for Membership

The Constitution of the Society, as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the Journal of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 24 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn, the

Council, urge the members to assume their share of responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by December 15, 1941, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	REFERENCES	
	Proposers	*Seconders*
BANKS, JOHN B., Branch Mgr., Minneapolis-Honeywell Regulator Co., Portland, Ore. (*Reinstatement*)	J. D. Kroeker B. W. Farnes	Frank Urban, Jr. T. E. Taylor
BENNETT, MERLE F., Chief Engr., First National Bank Bldg. Co., Detroit, Mich.	Harold Clark Glen Winans	F. X. Marzolf Fred Kaiser
BRUCE, MARSHALL, Asst. Secy., George W. Akers Co., Detroit, Mich.	Fred Kaiser F. X. Marzolf	W. H. Old F. C. Purcell
CUMMINGS, THOMAS P., Sales Engr., Hayes Furnace Mfg. Co., Los Angeles, Calif.	A. J. Hess E. N. Kendall	Harrold English H. B. Lauer
DISNEY, MELVIN A., Associate Engr., U. S. Engineer, Galveston, Tex. (*Advancement*)	T. H. Anspacher M. L. Brown	H. B. Wells (*non-member*) T. W. Elam (*non-member*)
EATON, WILLIAM G. M., Engr., Pease Foundry Co. Ltd., Toronto, Ont., Canada (*Advancement*)	H. B. Jenney D. O. Price	D. I. Paul S. A. Jennings
GREILING, WINFORD W., Mech. Engr., Austin Co., Detroit, Mich.	W. H. Old F. X. Marzolf	Fred Kaiser F. C. Purcell
GRIBBON, J. HARRY, Gen. Mgr., Northwest Stove & Furnace Works, Inc., Portland, Ore.	E. A. Ponder B. W. Farnes	J. D. Kroeker T. E. Taylor
HARVEY, JOHN W., Sales and Design Engr., York-Shipley Ltd., London, England.	J. J. Fraser C. B. Morrison	J. R. Hertzler V. T. Kartorie
HIMSEL, STANLEY R., Mgr., Htg. Dept., L. L. Felkep Co., Marshfield, Wis.	C. L. Dean G. L. Larson	George Hall D. W. Nelson
KIDD, CHARLES R., Htg. and Vtg. Engr., Defense Housing, P. B. A., Washington, D. C. (*Advancement*)	E. W. Gray H. M. McGaughey	A. R. Morin H. H. Koster
KLINK, ERWIN J., Mech. Engr., Johnson Service Co., Detroit, Mich.	J. S. O'Gorman, Jr. F. X. Marzolf	Fred Kaiser F. C. Purcell
LIVELY, GEORGE P., Engr. (Naval Archt.), Navy Dept., Bureau of Ships, Washington, D. C.	A. E. Stacey, Jr. R. M. Watt, Jr.	E. R. Queer W. C. Whittlesey
MARSHALL, ORVILLE D., Mfrs. Agent, Grand Rapids, Mich.	H. D. Bratt W. W. Bradfield	L. G. Miller F. C. Warren
MCCOY, EMMET F., Engr., Suburban Air Conditioning Co., Mt. Vernon, N. Y.	Thomas Baker H. J. Rose	C. Stewart Koehler C. R. Hiers
NELSON, AXEL A., Chief Engr., Federal Reserve Bank Bldg., Kansas City, Mo.	H. J. Nottberg Carl Clegg	K. M. Stevens L. A. Stephenson
O'CONNELL, THOMAS D., Pres.-Mgr., Thomas O'Connell Ltd., Montreal, Que., Canada.	G. L. Wiggs C. W. Johnson	W. E. Baxter R. R. Noyes
ROSAS, MILTON L., Sales Engr., Minneapolis, Minn.	R. E. Gorgen R. C. Jordan	A. B. Algren H. M. Betts
SCHERGER, FRED J., Sales Engr., Mundet Cork Corp., Detroit, Mich.	F. X. Marzolf Fred Kaiser	W. H. Old F. C. Purcell
SHORT, WILLIAM W., Field Sales Engr., Anemostat Corporation of America, New York, N. Y.	J. B. Hewett V. F. Self	F. J. Kurth Friedrich Honerkamp
SMOOT, CHARLES B., Chief Engr., Carrier Corp., Atlanta, Ga.	I. B. Kagey, Jr. C. L. Templin	S. W. Boyd A. H. Koch
WATSON, WILLIAM W., Mfrs. Agent, Detroit, Mich.	W. H. Baldwin J. S. Kilner	E. H. Clark F. R. Bishop
WELLS, DONALD E., Sales Repr., Globe Machinery & Supply Co., Des Moines, Ia.	C. W. Helstrom A. L. Walters	Perry LaRue F. E. Triggs
WOOLSTON, ROBERT H., Engr., Woolston Woods Co., Philadelphia, Pa.	A. H. Woolston M. F. Blankin	C. D. Dietz H. H. Erickson

Candidates Elected

In the past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and balloted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sec. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

CALDWELL, ROBERT J. STANLEY, Engr., Carrier Engineering, S. A. Ltd., Johannesburg, S. Africa.

LIGE, WALTER W., Mgr., Bell & Gossett Co., Pittsburgh (16), Pa. (*Advancement*)

SHEPARD, CARL R., Inspection Engr., Public Bldgs. Administration, San Francisco, Calif.

ASSOCIATES

ANDREWS, WILLIAM G., Sales Engr., Detroit Lubricator Co., New York, N. Y.

DICKENS, LESTER A., Mgr., Dickens Scheufler Burens, Inc., Cleveland Heights, O.

GUNTHORPE, CHARLES E., Mgr. Htg. Equip. Dept., Campbell Coal Co., Atlanta, Ga.

NORTON, L. IVAN, Sanitary and Heating Engr., Eveready Plumbing & Heating Co., Washington, Ia.

JUNIORS

MOULD, HARRY W., JR., Student Engr., Buffalo Forge Co., Buffalo, N. Y.

WAY, WILLIAM J., II, Partner, Way Engineering Co., Housto Tex.

Heating • Piping and Air Conditioning

January - December, 1941—Vol. 13, Nos. 1-12

Published monthly by the Keeney Publishing Company, 6 N. Michigan Ave., Chicago, Ill.

As will be noted, these abstracts are classified under general heads. In looking for information on a specific subject, it will be well to look through the abstracts under the most suitable heading, and also to look through those under other headings. For example, some of the heating articles also contain information on air conditioning, and vice versa, as the grouping has been made on the basis of the subject most prominently covered in the article.

The index to the Journal Section *of the* American Society of Heating and Ventilating Engineers *is separate (see page* 806).

This index does not include Equipment Developments; Book Reviews; Useful Information; Trade Literature; Coming Events—departments appearing regularly each month. The Editor's Pages in each issue include items of news, comments on current events, etc. In the January issue a complete directory section was published covering heating, piping and air conditioning equipment for industry and large buildings.

Air Conditioning

Adsorbers Guard Telephone Equipment
Vol 13, *No.* 9. *September*, 1941. *p.* 557
Adsorbers installed in telephone exchange to remove gaseous impurities from the ventilating air; impurities tarnish silver contactors of the automatic selectors.

Advances in Textile Drying
Vol. 13, *No.* 3. *March*, 1941. *p.* 166
Abstract of paper by Fred Kershaw on advancements in the drying of textiles; drying with radiant heat; drying with heated air; automatic machine for squeezing, sizing and drying washed rugs.

Air Change—Once a Major Criterion, by C. M. Ashley
Vol. 13, *No.* 3. *March*, 1941. *p.* 171
Use of the criterion "air change" in design of air conditioning systems should be abandoned; method is useless for determining ventilation requirements and if used may result in drafts; two methods of introducing and removing air to a store building show that air change criterion gives misleading results; of no help in determining ventilation requirements; factors which affect need for ventilation air; formula for determining maximum cfm for a room. (Discussion on p. 230, April; pp. 299 and 302, May; pp. 364-365 June; and p. 438, July).

Air Change—Once a Major Criterion, by S. H. Downs
Vol. 13, *No.* 4. *April*, 1941. *p.* 230
("Open for Discussion"); comment on article of above title by C. M. Ashley, published in March HPAC; necessity for other yardsticks as a means of measurement; importance of distribution; drafts; ASHVE committee working on the problem.

Air Change—Once a Major Criterion, by Will D. Sampson
Vol. 13, *No.* 6. *June*, 1941. *p.* 364
("Open for Discussion"); comment on article by C. M. Ashley on air change published in March HPAC, and the discussion on the article; air change with light occupancy loads; right answer lies somewhere between extremes of high air circulation with no temperature or humidity control, and low air circulation with temperature and humidity control.

Air Cleaning Helps Boost Business, by A. E. Agnew
Vol. 13, *No.* 3. *March*, 1941. *p.* 170
Modernization of Alexandra skating rink, Hamilton, Ont., included installation of electrostatic air cleaner; cleaning costs reduced; tobacco, smoke and skating powder dust removed; installation of equipment; attendance increased.

Air Conditioned Blast Furnace
Vol. 13, *No.* 1. *January*, 1941. *p.* 40
Air conditioning equipment to be installed for removing moisture from air supplied to No. 1 blast furnace at Aliquippa Works of Jones & Laughlin Steel Corp.; reason for air conditioning.

Air Conditioning Aids Copper Production for Defense Needs
Vol. 13, *No.* 9. *September*, 1941. *p.* 557
Short article on extension of air conditioning of the Magma Copper Co., Superior, Ariz.; high rock temperatures make air conditioning necessary; capacity of centrifugal refrigeration machines.

Air Conditioning Can Solve Expected Crisis in Iron and Steel Production
Vol. 13, *No.* 5. *May*, 1941. *p.* 55 (*front section*)
Prediction by Dr. Willis H. Carrier that stepping up production of blast furnaces by means of air conditioning will solve crisis; advantages of air conditioning blast furnaces; improvement in production and in quality; annual production of steel; cost of constructing new blast furnaces compared with cost of air conditioning existing blast furnaces; explanation of function of blast furnace.

Air Conditioning Coils, by G. L. Tuve
Vol. 13, *No.* 1. *January*, 1941. *p.* 42
("Open for Discussion"); importance of article by F. F. Stevenson in October, 1940, HPAC on choosing between a small or high temperature rise for water coils in air conditioning work.

Air Conditioning Contractor, The, by J. M. Sperzel
Vol. 13, *No.* 4. *April*, 1941. *p.* 219
The final steps which are important to installation of good air conditioning systems; balancing air distribution; providing for unforeseen conditions; instructing the operating men; painting the equipment; responsibility of contractor after system is in operation.

Air Conditioning Contractor, The—Coördination Is Vital, by J. M. Sperzel
Vol. 13, *No.* 1. *January*, 1941. *p.* 29
Importance of careful coördination between engineering and construction to installation of good air conditioning systems; need for an orderly delivery schedule; checking with other trades; determining elevation of work; suggestions for hoisting equipment into place; completion of apparatus rooms.

Air Conditioning for Defense
Vol. 13, *No.* 12. *December*, 1941. *p.* 751
Illustration of air conditioned room at Mergenthaler Linotype Co., where delicately adjusted instruments are being made for national defense; importance of temperature and humidity control.

Air Conditioning for Protection, by G. K. Saurwein
Vol. 13, *No.* 5. *May*, 1941. *p.* 311
New rare book library being constructed at Harvard University, Cambridge, Mass.; air conditioning will protect valuable collection of books and manuscripts; heating system of the split type with hot water cast iron convectors and warm air for general heating and ventilation; the air distribution system; sound absorption; method of constructing conditioner cabinet; 30 ton "Freon" compressor and 55 F well water; controls; schematic diagram of air conditioning system.

Air Conditioning Industry Offers Priority Program to Government
Vol. 13, *No.* 11. *November*, 1941. *p.* 693
Report presented to Office of Production Management October 22, by OPM subcommittee No. 4, priorities, ratings, and allocations, air conditioning and refrigeration industry (industrial and commercial); definition of air conditioning and refrigeration; three divisions of the industry; 39.9 per cent of output currently for defense; essential industry; workers highly skilled; proposed plan sets up essential civilian uses, less essential civilian uses, and non-essential uses; blanket rating of A-3 suggested for essential civilian uses with lower rating for less essential uses, and no rating for non-essential uses; statistical information on the industry, including number of persons employed, annual payrolls, orders booked, installed cost to users, unfilled orders, purchases by manufacturers, floor space occupied and quantities of principal materials used; essential civilian uses, less essential civilian uses, and non-essential uses of air conditioning equipment; typical industries involved in defense or essential civilian requirements for which refrigerating and air conditioning equipment is necessary.

Air Conditioning Keeps on Growing at the Rockefeller Center Project, by C. W. Walton, Jr.
Vol. 13, *No.* 2. *February*, 1941. *p.* 89
Growth of air conditioning at Rockefeller Center, New York City; refrigerating capacity; changes in air conditioning methods during period of expansion; description of systems for theaters, radio studios and stores; cooling towers; centrifugal water vapor refrigeration machine installed on 58th floor; selective cooling system; demand for air conditioning expands with newer buildings; new units and recent enlargement; additional units will be required within two or three years; diagram showing major refrigeration plant and chilled water distribution; plot plan showing location of conditioning equipment and piping services.

Air Conditions for Efficiency of Draftsmen
Vol. 13, *No.* 7. *July*, 1941. *p.* 422
Tennessee Valley Authority to install air conditioning in drafting rooms to increase efficiency; results of study made by Detroit Edison Co. on advantages of air conditioned drafting room; operating and maintenance costs for air conditioned building compared with non-air conditioned building.

Aircraft Assembly Plant
Vol. 13, *No.* 12. *December,* 1941. *p.* 739
Brief description and progress photograph of Fort Worth, Tex., aircraft assembly plant; new method of wall and roof construction developed to provide insulation; 7000 tons of refrigeration for air conditioning.

Air Discharge from Narrow Slots, by J. R. Fellows
Vol. 13, *No.* 9. *September,* 1941. *p.* 558
("Open for Discussion"); comments on articles by F. F. Stevenson on air discharge from narrow slots published in May and June HPAC; theoretical considerations involved; effect of area of the opening and static pressure; tests on model of Holland vehicular tunnel run by Professors A. C. Willard and A. P. Kratz; formula for total pressure at any location in duct supplying air through slots; friction loss formula; static pressure regain.

Air Discharge from Narrow Slots, by D. W. Nelson
Vol. 13, *No.* 9. *September,* 1941. *p.* 559
("Open for Discussion"); comment on articles by F. F. Stevenson on air discharge from narrow slots published in May and June HPAC; movement of air through duct and discharge from slots a complex problem; an open hole is a poor grille; advantages of using diffusing grilles; discharge coefficients; static regain; throw of air. (Also see p. 690, November.)

Air Discharge from Narrow Slots, by F. F. Stevenson
Vol. 13, *No.* 5. *May,* 1941. *p.* 308
Very little information available on air distribution through narrow slots; applications of the method; slot construction; coefficient of discharge; air throw; pressures and velocities; empirical friction loss formula.

Air Discharge from Narrow Slots, by F. F. Stevenson
Vol. 13, *No.* 6. *June,* 1941. *p.* 368
Loss due to turn of direction of air flow; turning vanes; static pressure regain; relationship between static pressure and discharge velocity; discharge at far end of duct; effect of high initial velocity in duct; throw of air from slot; formula for figuring throw; readings of air flow taken on an installation. (Discussion on pp. 558-560, September, and p. 690, November.)

Air Discharge from Narrow Slots, by F. F. Stevenson
Vol. 13, *No.* 11. *November,* 1941. *p.* 690
("Open for Discussion"); comment on discussion of articles by Prof. J. R. Fellows and Prof. D. W. Nelson, published in September HPAC; derivation of formula for throw of air from slots; coefficient of discharge; rational formula for throw as given by Prof. C. O. Mackey; standard definition for throw should be adopted.

Air Raid Shelter Ventilation
Vol. 13, *No.* 3. *March,* 1941. *p.* 159
Abstract of paper by C. Gordon Huntley published in the Journal of the (British) Institution of Heating and Ventilating Engineers; home office regulations; mechanical ventilation of shelters; lighting restrictions; light restricting baffles.

Almost Fits the Pocket, by Henry W. Moore
Vol. 13, *No.* 3. *March,* 1941. *p.* 149
Description of unusual central station air conditioning system at the Kettering Laboratory of Applied Physiology, Cincinnati, Ohio; total air supplied is only 207 cfm; construction of animal boxes; design conditions; heat liberated by rabbits; washable steel filter and electric precipitator filter; the cooling and dehumidifying coil; 2 hp compressor; 2 in. copper ducts; ceiling outlets; control; results.

Balconies Designed to Cut Cooling Load
Vol. 13, *No.* 12. *December,* 1941. *p.* 754
New Longfellow building in Washington, D. C., has balconies on westerly wall for reducing sun heat gain through windows; sketches showing sunlight on windows at various times of day on August 1; advantages of permanent projections or balconies; saving in cooling load.

Black Hole of Calcutta, by J. M. Frank
Vol. 13, *No.* 4. *April,* 1941. *p.* 230
("Open for Discussion"); comment on article "Air Change—Once a Major Criterion," by C. M. Ashley published in March HPAC; air change was "a major criterion" in the Black Hole of Calcutta tragedy.

Black Hole of Calcutta, The, by Carl F. Boester
Vol. 13, *No.* 6. *June,* 1941. *p.* 365
("Open for Discussion"); comment on previous discussion referring to Black Hole of Calcutta; deaths due to too high a mean radiant temperature rather than lack of ventilation.

Black-Out!
Vol. 13, *No.* 4. *April,* 1941. *p.* 237
Thousands of tons of refrigeration being installed for air conditioning windowless defense plants; new Texas unit of North American Aviation, Inc. is an example; design conditions; summer and winter operation; four 650 ton centrifugal compressors; air conditioning equipment in penthouses; air distribution; motors; forced draft cooling tower; cooling tower requirements.

Calibrate Range Finders at 75 F, 50 Per Cent Humidity
Vol. 13, *No.* 10. *October,* 1941. *p.* 614
Air conditioning used in testing and calibrating range finders at government's Raritan, N. J. arsenal.

Can Ceiling Outlets Kayo Ceiling Smudge?, by F. W. Wills and G. F. Nightingale
Vol. 13, *No.* 11. *November,* 1941. *p.* 682
Ceiling diffuser represents great advance in air distribution; use limited by its habit of smudging the ceiling; authors study various jobs to find out cause of smudge; supply air is the culprit; importance of good filters, their proper installation, and a tight sheet metal job; what the architect or engineer should specify in order to keep ceilings clean; pattern of air motion with ceiling diffusers. (Comment on p. 752, December.)

Can Ceiling Outlets Kayo Ceiling Smudge?, by John C. Knox
Vol. 13, *No.* 12. *December,* 1941. *p.* 752
("Open for Discussion"); comment on article by F. W. Wills and G. F. Nightingale published in November HPAC; difficulties in using ceiling outlets or diffusers that are flush with the ceiling surface; induction of room air a problem.

Chilled Water Circulating Systems for Storage Air Conditioning Jobs, by William Goodman
Vol. 13, *No.* 9. *September,* 1941. *p.* 561
Discussion of two types of piping systems used for circulating chilled water or brine from storage tanks to air cooling coils or heat transfer surfaces; the closed system and the open system; advantages; need for a balancing tank; avoiding a vacuum in the piping system; disadvantage of open system; using system for heating; controls; importance of thorough mixing of stored water.

Chilled Water Storage Tanks Allow Economies in Compressor Operation, by William Goodman
Vol. 13, *No.* 8. *August,* 1941. *p.* 502
Advantages of using chilled water storage tanks with reciprocating compressors; storage tank will allow compressor to operate at about full load whenever it is running, and time that compressor runs will be practically in direct proportion to cooling load; method of sizing storage tank; table showing on and off times of compressor with storage systems in which compressor capacity is greater than average load; table showing water storage in gallons per ton of compressor capacity for various allowable temperature rises of the water in the tank; examples showing use of the data; method of computing table.

Chlorinated Solvents Under Rigid Control
Vol. 13, *No.* 11. *November,* 1941. *p.* 683
Director of priorities places all stocks of chlorinated solvents under rigid control; used in manufacture of refrigerants.

Clever Idea
Vol. 13, *No.* 11. *November,* 1941. *p.* 691
Illustration showing closet location of air conditioning units in Brooklawn Apartments, Hartford, Conn.; bookcase built into closet door; hot water is the heating medium and well water the cooling medium; two air outlets in each apartment living room.

Compressor Horsepower Tables, by R. J. Thompson
Vol. 13, *No.* 1. *January,* 1941. *p.* 41
("Open for Discussion"); comment on article by William Goodman on horsepower requirements of refrigerating compressors published in December, 1940, HPAC; table prepared by Goodman should prove extremely useful; tonnage of refrigeration also a factor; data offer many short cuts in calculations.

Conditioning Bombproof Underground Spaces
Vol. 13, *No.* 7. *July,* 1941. *p.* 416
Brief abstract of article on conditioning of bombproof underground spaces for shelters and factories; temperature in underground spaces; methods of removing moisture; evaporation of water from surfaces of porous masonry; reasons for air conditioning; two distinct methods used for ventilating gasproof shelters.

Construction for Defense—Testing Army Aircraft Engines, by T. H. Eakle, Jr.
Vol. 13, *No.* 4. *April,* 1941. *p.* 226
Stratospheric testing laboratories at Wright Field, Dayton, Ohio; cooling plant provides air testing temperatures down to 67 F below zero; how stratospheric conditions are simulated in the laboratory; three separately controlled cooling stages; ammonia compressors; wind tunnel divided into sections; common condensing system; reheaters use ethylene glycol.

Conversation Piece
Vol. 13, *No.* 5. *May,* 1941. *p.* 299
("Open for Discussion"); comments of C. M. Ashley and J. M. Frank on air change as a criterion of design, with particular reference to article by Mr. Ashley in March HPAC; how designer of modern ventilation systems would have figured a system for Black Hole of Calcutta; difference of viewpoint largely a matter of terminology. (Discussion on pp. 364 and 365, June.)

Converting Ventilating Systems to Summer Air Conditioning, by G. A. Belsky
Vol. 13, *No.* 3. *March,* 1941. *p.* 177
Existing duct systems utilized for summer air conditioning Corinthian and Oval rooms at Hotel Pierre, New York City; installation of return ducts impractical so 100 per cent outside air was used; advantages of making as few changes in original ventilating system as possible; air distribution; directional flow grilles; ductwork and plenum chambers insulated with cork; rock wool insulates supply ducts at window jambs; three 20 hp refrigeration machines with direct expansion coils; evaporative condensers installed on roof of court; preventing vibration and machine noise; air conditioning Cafe Pierre in same hotel.

Doing a Job for Defense, by W. S. Bodinus
Vol. 13, *No.* 11. *November,* 1941. *p.* 703
Thousands of tons of centrifugal refrigeration compressors on the job for air conditioning defense plants; principle of operation of such a compressor; basic elements; operating head for a given constant speed changes very little; continued increase of load causes automatic unloading; ratio of speed reduction to capacity reduction is small; typical performance curves for a typical centrifugal refrigeration machine.

Drug Store Conditioned, by J. T. Schaefer
Vol. 13, *No.* 1. *January,* 1941. *p.* 42
("Open for Discussion"); brief description of air conditioning equipment installed in Bullard and Shedd Co., Keene, N. H., oldest drug store in the state; comments of the general manager on the value of air conditioning a drug store.

Dust Concentration, by Richard S. Dill
Vol. 13, *No.* 1. *January,* 1941. *p.* 41
("Open for Discussion"); comment on article by Frank B. Rowley and Richard C. Jordan published in December, 1940, HPAC; study of soiling of walls, drapes and other objects suggested.

Effect of Air Velocity on Wet Bulb Readings, by William Goodman
Vol. 13, *No.* 3. *March,* 1941. *p.* 174
("Open for Discussion"); mean error in wet bulb temperature readings for various air velocities over the wet bulb; method of making correction; basis of the constant value of 1.6 per cent; difference between temperature of adiabatic saturation and wet bulb temperature; use of shielded and unshielded wet bulb thermometers; references to five papers giving original data on the subject.

Evaporative Cooling Map, by A. J. Rummel
Vol. 13, *No.* 1. *January,* 1941. *p.* 43
(HPAC data sheet); studies on operation of direct evaporative cooling for comfort indicate most satisfactory results obtained when outside dry bulb temperature during the day time is 90 F or more, and outside wet bulb temperature is below 75 F; map prepared from meteorological records of U. S. Weather Bureau shows contour lines for June, July, August and September, indicating number of hours dry bulb temperatures above 90 F, and number of hours dry bulb temperatures above 90 F plus number of hours wet bulb temperatures below 75 F, from 9:00 a.m. to 5:00 p.m.; comments on suitability of evaporative cooling in various cities.

Explosion Hazards in Hospital Operating Rooms, by V. L. Sherman
Vol. 13, *No.* 3. *March,* 1941. *p.* 161
Research undertaken on explosion hazards in hospitals with modern anesthetic gases; cause of explosions; effect of humidity; two schools of thought among anesthetists; research committee organized; use of "non-static" rubber in preventing static sparks; a great field for air conditioning engineers.

Filtering and Dust Collection, by H. C. Murphy
Vol. 13, *No.* 1. *January,* 1941. *p.* 41
("Open for Discussion"); comment on article by Frank B. Rowley and Richard C. Jordan published in December, 1940, HPAC; need for differentiation between dust collection problems and those involved in general air conditioning; standard code for testing and rating air cleaning devices differentiates between the two fields.

Flooded Roof, Double Pane Windows Assist in the Control of Air Conditions, by M. C. Haley
Vol. 13, *No.* 4. *April,* 1941. *p.* 235
Roof pond reduces air conditioning load at new bakery of Loose-Wiles Biscuit Co., Oakland, Calif.; several factors taken into consideration; details of the roof construction; roof drains; advantages of ponding roofs; wall construction of the bakery; use of double pane and heat absorbing glass for windows. (Discussion on p. 280, May.)

Flooding Roofs
Vol. 13, *No.* 5. *May,* 1941. *p.* 280
Comment by E. P. Heckel on article by M. C. Haley published in April HPAC; heat resistance from a 2 in. still water pond; limitations of idea.

For Defense
Vol. 13, *No.* 5. *May,* 1941. *p.* 314
General office for Westinghouse steam division plant at Lester, Pa., air conditioned by steam jet refrigeration equipment; water on roof reduces sun heat gain; windows of glass block construction with "islands" of double pane clear glass; water coils supplied with heated water in winter; air cleaned electrostatically.

For Defense—Dry Blast Speeds Steel Production, by W. E. Barnum.
Vol. 13, *No.* 6. *June,* 1941. *p.* 365
Contract awarded by Sloss-Sheffield Steel and Iron Co., Birmingham, Ala., for equipment for dehumidifying air fed to blast furnaces; advantages of dry blast; system will condition 90,000 cfm by means of single turbo-compressor water cooling unit driven by 900 hp steam turbine, and a special dehumidifier; dry blast not a new idea in steel circles; early installations; Republic Steel Corp. will shortly put in operation a modern dry blast system.

4000 Ton Decentralized Air Conditioning System for Big Black-Out Plant, by H. M. Hendrickson
Vol. 13, *No.* 5. *May,* 1941. *p.* 307
New black-out assembly plant of Douglas Aircraft Co., North Long Beach, Calif.; high internal heat loads; conditions to be maintained; 69 separate air conditioning systems being installed; equipment location; sizes of the air conditioning systems and the buildings they serve; decentralized installation should prevent plant being put out of commission by one well directed bomb.

From 0 to 15,000 + Feet, by W. W. Davies
Vol. 13, *No.* 3. *March,* 1941. *p.* 175
Air conditioning truck unit for heating or cooling airplanes on the ground; method of operation; performance of the unit on the heating and the cooling cycles; cabin supercharging for flight at high altitudes; comparison of actual flight altitude and supercharged cabin altitude for typical 3 hr trip; temperature rise due to adiabatic compression.

Gas Engine Drives Compressor
Vol. 13, *No.* 9. *September,* 1941. *p.* 566
Illustration and brief description of natural gas engine driving compressor for air conditioning Hilton Hotel, Longview, Texas; cost of gas; gas consumption; oil changes; savings; controls.

G. E. Conditions Its New Blackout Plant
Vol. 13, *No.* 9. *September,* 1941. *p.* 570
Description of blackout type airplane supercharger factory of the General Electric Co. at Everett, Mass.; large internal heat load; accurate temperature control necessary because of the aluminum and magnesium alloy machining processes; eighteen 60 hp reciprocating condensing units and direct expansion coils; location of equipment; pneumatic controls; air distribution; method of heating; 1200 ton cooling tower.

Heat Repels Dirt
Vol. 13, *No.* 11. *November,* 1941. *p.* 698
Why a hot surface remains cleaner in a dusty atmosphere than a cold surface; principle utilized in dust sampling instrument; possibility of applying principle to dust filtering.

High Limits of Air Change, The, by D. J. Stewart
Vol. 13, *No.* 7. *July,* 1941. *p.* 438
("Open for Discussion"); not practical to handle unlimited volumes of air without draft; maximum permissible number of air changes varies with occupancy or use of space, its shape, location of supply and exhaust grilles, and velocity at which they operate; high limit for any room is approximately 30 air changes per hour.

Horsepower for Compressors, by Leon Buehler
Vol. 13, *No.* 3. *March,* 1941. *p.* 173
("Open for Discussion"); comment on articles by William Goodman; value of horsepower per ton of refrigeration also of interest; actual hp per cu ft affected by the superheat condition.

Horsepower Requirements of Refrigerating Compressors, by William Goodman
Vol. 13, *No.* 1. *January,* 1941. *p.* 20
Advantage of using horsepower per cubic foot of gas compressed instead of horsepower per ton in computing theoretical horsepower required for refrigerating compressors; superheated suction vapor; critical compression ratio; maximum horsepower; table of horsepower per cubic foot of vapor compressed per minute for ammonia; table of critical compression ratios and constants for determining maximum theoretical horsepower. (Discussion on p. 41, January; and p. 173, March.)

Horsepower Requirements of Refrigerating Compressors, by William Goodman
Vol. 13, *No.* 2. *February,* 1941. *p.* 108
Examples showing agreement between computed and tabulated values of maximum theoretical horsepower; maximum brake horsepower; values of the ratio of volumetric efficiency of compressor to overall power efficiency; values of the ratio of the specific heats for "Freon-12" and ammonia; comparison of "Freon-12," ammonia and carbon dioxide.

Hotel Engineering—How to Save Electricity
Vol. 13, *No.* 8. *August,* 1941. *p.* 508
Review of study issued by American Hotel Association of the United States and Canada; electric current cost in hotels; how hotel operators can study their power consumption; power requirements of guest room air conditioning units; saving electric current required for air conditioning equipment operation; maintenance of equipment; importance of operating ventilation equipment only when needed; power requirements of ventilating fans; operating hours should be scheduled.

How Air Conditioning Aids Defense, by Edward T. Murphy
Vol. 13, *No.* 7. *July,* 1941. *p.* 414
Installation of air conditioning equipment at Kollsman Div. of Square D Co., Elmhurst, L. I., will speed production of airplane instruments; 15 ton system and silica gel dehydrator; importance of maintaining low humidity; advantages of air conditioning inspection and testing department; air conditioning will increase efficiency of workers.

How Air Conditioning Serves Industry
Vol. 13, *No.* 5. *May,* 1941. *p.* 283
Four examples of industrial applications of air conditioning; air conditioning units installed for manufacture of precision grinding spindles at Landis Tool Co., Waynesboro, Pa.; gas adsorbing equipment installed in crane cabs at smelting plant to safeguard operators' health; electrostatic air filter cleans air at laboratories of Farnsworth Radio and Television Corp. at Ft. Wayne, Ind., where television tubes are made; air conditioning aids production in diamond sawing room of Baumgold Bros., New York, N. Y.

How Does Solar Heat Gain Through Frosted and Plain Glass Compare, by F. C. Houghten
Vol. 13, *No.* 9. *September,* 1941. *p.* 575
Answer to a reader's question on solar heat gain through frosted glass; review of studies on solar heat gain through glass; it can be assumed that solar heat gain through frosted glass is not materially different from plain glass. (Comment on p. 753, December.)

How Often Should Water in Air Conditioning System Be Changed?, by Samuel R. Lewis
Vol. 13, *No.* 12. *December,* 1941. *p.* 746
Answer to reader's question on draining chilled water from air conditioning system of 10 air washers and changing condenser water; pH value; use of ozone and chlorine; usage and operating conditions for each installation require individual solutions.

HPAC'S Annual Air Conditioning Review
Vol. 13, *No.* 2. *February,* 1941. *p.* 103
Comparative data on number of air conditioning installations and connected horsepower for air conditioning commercial, industrial and residential buildings for 1939, first eleven

months of 1940, and totals as of December 1, 1940; estimates for 1941; trend to black-out proof plants of windowless construction; sales gains during 1940; progress in the field of gas using summer air conditioning equipment; developments of various manufacturers of gas using equipment; sales status of summer air conditioning with gas.

Ignorance Is No Excuse, by Lawrence R. Bloomenthal
Vol. 13, *No.* 9. *September,* 1941. *p.* 564
The law presumes industry to have knowledge of health hazards and take means to prevent them; review of several cases; lack of knowledge; inexperienced employees; location of work; importance of modern equipment, and good operation and maintenance; statutory violations; use of gas masks. (Comment on p. 692, November.)

Improves Welding Facilities
Vol. 13, *No.* 5. *May,* 1941. *p.* 313
Several improvements in welding facilities made at Reliance Electric & Engineering Co., Cleveland, Ohio; canvas enclosures for welding booth and their construction; exhaust system for removing welding fumes; 5 in. flexible tubing connection to each booth from overhead main ventilating line.

Improving the Plant Heat Balance, by W. S. Bodinus
Vol. 13, *No.* 3. *March,* 1941. *p.* 154
Centrifugal refrigeration compressor driven by steam turbine can be used to improve heat balance; turbine driven centrifugal machine can be installed to operate in parallel with existing reciprocating compressors; sketch showing method of cross-connecting centrifugal and reciprocating compressors; operation of system.

Increased Taxes and Selling Costs Make Efficient Operation in Plants and Buildings Much More Important, by A. J. Rummel
Vol. 13, *No.* 7. *July,* 1941. *p.* 428
Two year study on operation of air conditioning systems; inefficient operating practices revealed; operating efficiency getting more attention because of increased taxation and selling costs; method of studying power consumption for air conditioning department stores; consideration of a typical department store and its air conditioning system; kilowatt demand of the store for lighting, elevator and other uses, and for air conditioning; how the power bill is computed; study of kilowatt demand for air conditioning compressors made during one monthly period; compressors operated when not necessary; analysis of demand actually established and demand that would be required with more careful operation; better operation would have saved $161.62 on power bill in one month; use of outside air rather than recirculated air to reduce cost of air conditioning when outdoor wet bulb temperature is satisfactory.

Industrial Health Defense—How Plant Engineers Can Make Field Measurements of Industrial Ventilation, by W. C. L. Hemeon
Vol. 13, *No.* 1. *January,* 1941. *p.* 25
Importance of development of industrial ventilation standards; how plant engineers can assist in the work; what must be known about an industrial ventilation system; devices used by the Massachusetts division of occupational hygiene; chemical smoke producers; U-tube manometer; movable scale for manometer simplifies its use; pitot tubes and accessory equipment for making traverses; use of inclined gage and a support for it; making test holes; closure for test holes; direct reading velocity meters; carrying case for equipment used in field measurements.

It's a Job, by W. E. Lowell
Vol. 13, *No.* 7. *July,* 1941. *p.* 415
Difficult to find space in existing buildings for air conditioning equipment; how the problem was solved at First National bank building, Elkhart, Ind.; impossible to find space for an ideal air distributing system; space adjacent to revolving door casing used; directional flow register installed at top of door; excavation made under sidewalk to house air conditioner; well water is cooling medium; waste water from unit serving upper floors discharged on to roof.

I Want to Compliment
Vol. 13, *No.* 7. *July,* 1941. *p.* 438
("Open for Discussion"); comment of W. J. Davis on article Air Change—Once A Major Criterion, by C. M. Ashley published in March HPAC; Mr. Ashley should be complimented on his article.

Keep 'Em Flying—Army Air Corps' New Slogan Involves Carefully Planned Engine Testing Facilities, by F. W. Swan, Jr.
Vol. 13, *No.* 7. *July,* 1941. *p.* 405
Test set-ups for single cylinders and complete airplane engines; single cylinder cooling; complete engine cooling; description of a large installation recently made; three separate test stands; centrifugal fans; motors; dampers; control rooms; heavy construction used; performance curve for one of the 600 hp fans; torque stands for running in completed engines.

Leading with His Chin, by Lester T. Avery
Vol. 13, *No.* 6. *June,* 1941. *p.* 364
("Open for Discussion"); comment on article by C. M. Ashley on air change in March HPAC; Fig. 1 of Mr. Ashley's article represents a waste of air handling equipment; comments on air circulation as shown in Fig. 2 of Mr. Ashley's article; air change criterion valuable as a cross check; short circuiting of air from exhaust to supply air intake; importance of cleanliness of apparatus and arrangements for cleaning air conditioning equipment; operating instructions should include cleaning schedule.

Lights, Action, Air Conditioning!, by Arthur J. Hess
Vol. 13, *No.* 1. *January,* 1941. *p.* 17
Air conditioning in movie film processing plants or film laboratories and why it is necessary; how film is developed; importance of temperature and humidity control; air ventilation; standards for selection of air filters; brief description of laboratories of Warner Brothers, Burbank, Calif.; humidity control for film handling; the 20th Century-Fox studio, Hollywood; (also see article by Arthur J. Hess, October, 1940, HPAC).

Like a Spring Day—Air Conditioned, by Walter E. Gillham
Vol. 13, *No.* 4. *April,* 1941. *p.* 230
("Open for Discussion"); additional comment on air conditioning of Lincoln Liberty Life Insurance Co. building described by H. L. Schwenker in March HPAC; atmosphere is like that of a spring day; ample amount of outside air used; importance of operating system in the manner in which it was intended to be operated.

Measuring Air Flow at Intake (or Exhaust) Grilles
Vol. 13, *No.* 12. *December,* 1941. *p.* 740
New jet developed for use with swinging vane type direct reading air velocity meter for taking readings at intake (or exhaust) grilles; tests made by G. L. Tuve on the new jet; test methods; results; average total error; errors of instrument; effect of air velocity; effect of grille size; mean velocity meter factor; how to use instrument; photograph showing typical use.

Meat Packer Solves Cooling Problems
Vol. 13, *No.* 5. *May,* 1941. *p.* 290
High velocity air diffusers in refrigerated rooms solve problems of dehydration and reduce cooling time at Stahl-Meyer, Inc., meat packing plant, New York, N. Y.; dehydration reduced 2 per cent; greater comfort for employees; other advantages.

Meeting Different Air Conditioning Requirements With a Central System, by S. P. Engleton
Vol. 13, *No.* 1. *January,* 1941. *p.* 37
Description of Supreme Court building, Washington, D. C., and its air conditioning; building divided into 13 sections; capacity of the dehumidifiers and pumps; description of the six systems serving the building; air circulation; control of air conditions; method of supplying air to the courtroom; exhaust air from garage ventilating system cools condensing water.

Model Plant, by G. C. Dittman and O. M. Schneider
Vol. 13, *No.* 5. *May,* 1941. *p.* 284
New plant of United States Tobacco Co., Richmond, Va.; exhaust steam used for refrigeration and air conditioning in summer, and for heating in winter; two 150 ton centrifugal refrigeration machines driven by steam turbines operating on exhaust steam from engines; condensing water; same condenser used by engines in winter and turbines in summer; control of turbines; various air conditioning systems; location of equipment; conditions maintained; control; factory space heated by unit heaters operating on vacuum system; eight heating units supply air to two large tobacco dryers; flow diagram for the steam and water.

Modernizes with Air Conditioning, by E. A. Tyler
Vol. 13, *No.* 8. *August,* 1941. *p.* 506
Converting washed air ventilating system of First National Bank Building, St. Paul, Minn., to summer cooling system using well water; difficulty due to suspended matter in well water; how difficulty was corrected; changing fan room equipment for cooling; installation of diffusing grilles; cost of conversion job; auxiliary dampers on all outside air intakes save steam; estimated annual saving in purchased steam amounts to $1494.

Most Timely Article, by F. F. Espenschied
Vol. 13, *No.* 12. *December,* 1941. *p.* 752
("Open for Discussion"); comment on article by F. W. Wills and G. F. Nightingale on ceiling smudge with ceiling air outlets, published in November HPAC; smudging of wall surfaces not confined to ceiling diffusers; importance of good air filters; experience in the all-electric kitchen of a modern restaurant; smudge around each diffuser found to come from dust producing processes adjacent to diffuser; room dust does at least contribute to smudge on ceilings.

Motor Driven Centrifugal Compressor, The, by W. S. Bodinus
Vol. 13, *No.* 5. *May,* 1941. *p.* 303
Factors involved in selection of motor drive for centrifugal refrigeration compressors; peak air conditioning loads in various types of buildings; use of centrifugal machines with offpeak storage; centrifugal machines capable of simple control and maximum flexibility; compressor is easily unloaded.

Much Pleased With It, by Duncan J. Stewart
Vol. 13, *No.* 5. *May,* 1941. *p.* 302
("Open for Discussion"); comment on article on air change by C. M. Ashley published in March HPAC; the term "air change" frequently misused; data now available to select equipment with confidence to meet specified requirements. (Discussion on p. 364, June.)

National Gallery of Art Completed
Vol. 13, *No.* 3. *March,* 1941. *p.* 165
National Gallery of Art, Washington, D. C., to be accepted for the nation March 17; air conditioned to protect art treasures and for comfort of visitors and staff; three centrifugal refrigeration machines; spray water chemically treated; conditions to be maintained; special supply and exhaust system removes sun heat from under skylights; central control panel and typical air washer unit.

New Electroliners Offer Comforts of Air Conditioning
Vol. 13, *No.* 3. *March,* 1941. *p.* 160
All-electric articulated trains put into operation by Chicago North Shore & Milwaukee Railroad; entire structure insulated; double sash; floor heating by strip electric heaters; fin strip electric heaters also installed in ducts; method of ventilation and filtering; cooling; compressor condenser units under each center unit of train; control.

New Method of Duct Construction Simplifies Air Conditioning, by T. J. Cunningham
Vol. 13, *No.* 8. *August*, 1941. *p.* 495
Description of method of fabricating ducts which do not need to be concealed; sketches showing construction details; recommended sheet metal gages; advantages of method; illustrations of typical installations.

Noise Levels—How to Figure Them, by William Goodman
Vol. 13, *No.* 12. *December*, 1941. *p.* 737
Use of decibel unit for rating noise level of equipment has come into widespread use; convenient tables simplify computation of decibel noise levels; effect of equipment noise on room noise level; examples showing use of tables; how to use tables to determine equipment noise level when tests are run in noisy rooms; method of computing tables; list of minimum, maximum and representative noise levels in various types of buildings and vehicles.

Odorated Talking Pictures
Vol. 13, *No.* 1. *January*, 1941. *p.* 31
Demonstration of odorated or osmic talking pictures made at New York World's Fair.

On the Up and Up, by W. A. Stahl
Vol. 13, *No.* 8. *August*, 1941. *p.* 489
Tenant demand for air conditioning at Merchandise Mart, Chicago, Ill.; growth of air conditioning since building was constructed; types of equipment; condensing water taken from river; converting warehouse areas to finished tenant space; central water chilling plant installed at track level; centrifugal refrigeration machine on 20th floor; brick cooling tower; dry type and viscous filters used, as well as electrical precipitation units; welded chilled water piping; new pipe line insulated with cork at hangers only, with fill insulation between, due to difficulty of obtaining cork.

Ozone in Ventilation and Air Conditioning, by J. A. Robinson
Vol. 13, *No.* 12. *December*, 1941. *p.* 759
Conflicting views in respect to use of ozone for odor control in air conditioning and ventilation; influence of nitrogen oxides on toxicity; ozone free of oxides non-toxic, according to tests; installations of ozone generator which produces ultraviolet corona free from oxides of nitrogen; unit adds ozone to supply air for general offices of Libby, McNeill and Libby, in Chicago stockyards; space rented by Northern Trust Co. in Chicago office building takes air from alley; restaurant exhausts create odor problems solved by ozone; ozone installation at Marine Drive apartments, Chicago; ozone machines in penthouses supply corridors through small ducts; suggestions for engineering survey of an air odor problem.

Pays for Itself, by Edward T. Murphy
Vol. 13, *No.* 2. *February*, 1941. *p.* 98
Advantages of air conditioning Larkey Co. men's clothing store, Passaic, N. J.; increase in number of customers and number of sales; reduction in employees' errors and absences.

Piping and Control for Storage Air Conditioning, by William Goodman
Vol. 13, *No.* 11. *November*, 1941. *p.* 684
Arrangement of piping and controls in a storage tank system; three-way valves used for controlling water flow; arrangement of baffles in tank; controlling the compressor; motor overloading; derivations of formulas used.

Pix Biz Lix Kix—Says Nix To Old Man Weather
Vol. 13, *No.* 9. *September*, 1941. *p.* 550
Importance of air conditioning to the motion picture industry; description of extent of air conditioning at Walt Disney studio, Burbank, Calif.; amount of equipment; air changes; filtering; cost of air cleaning; well water supply; disposal of water; pneumatic controls.

Planned Sun Protection Reduces Cooling Load, by Les Avery
Vol. 13, *No.* 8. *August*, 1941. *p.* 487
Required air cooling capacity for taking care of solar heat load; cooling load calculations for two buildings showing load with bare glass, venetian blinds, and sun screen; use of sun screen allows installation of smaller room cooler; sun screen cuts one-third from cooling load; reducing solar heat gain through windows solves zoning problem.

Predicting Dust Concentration—How to Figure the Dust Concentration When Filtering Process Is Continuous, by Frank B. Rowley and Richard C. Jordan
Vol. 13, *No.* 2. *February*, 1941. *p.* 99
Equations derived for predicting dust concentrations in buildings; schematic diagram of typical filtering installation; equations and explanation of their significance; curves showing relationship between time of filtering and reduction in dust concentration; table showing frequency distribution and calculated settling velocities for atmospheric dusts; typical example of use of the data, showing method of making calculations.

Predicting Dust Concentration—How to Figure the Dust Concentration When Filtering Process Is Intermittent, by Frank B. Rowley and Richard C. Jordan
Vol. 13, *No.* 5. *May*, 1941. *p.* 304
Equations developed for figuring dust concentration with intermittent filtering of the air; physical significance of the equations; effect of length of the filtering periods on average dust concentration; effect of filtering efficiency on the ratio of interior to exterior dust concentration.

Production for National Defense—Air Conditioning a Necessity, by E. E. Herbacek
Vol. 13, *No.* 8. *August*, 1941. *p.* 492
Description of newly completed plant of Northern Pump Co., Fridley, Minn.; air conditioning the administration building; windows of double hermetically sealed glass; outside walls and roof insulated and sealed to reduce heat leakage and condensation; convector type steam radiation for heating; zoned air conditioning equipment; water pond on roof; air circulation; air diffusers; pneumatic control; exhaust systems.

Production for National Defense—Gages Essential to National Defense Production; Air Conditioning Essential to Gage Manufacture, by A. S. MacNeish
Vol. 13, *No.* 9. *September*, 1941. *p.* 567
Description of new gage building of Greenfield Tap & Die Corp., Greenfield, Mass.; air conditioning essential; the building air conditioning system; air distribution; direct expansion refrigeration; final inspection room separately air conditioned; temperatures maintained; water from condenser for inspection room system discharged to evaporative condensers for building system; surplus water used for flooding roof; conditions maintained and capacities of systems.

Production for National Defense—Modern Warfare Has Made the Air Conditioning of Plants Essential, by F. O. Jordan
Vol. 13, *No.* 11. *November*, 1941. *p.* 677
Importance of blackout factories; necessity for air conditioning; new Packard Motor Car Co. plant, Detroit, for production of Rolls Royce Merlin aircraft engines for RAF; four fan systems; equipment location; centrifugal compressors; operation of systems; controls; conditions maintained; operation during heating and cooling seasons.

Production for National Defense—New Data for Practical Design of Ventilation for Electroplating, by William P. Battista, Theodore Hatch and Leonard Greenburg
Vol. 13, *No.* 2. *February*, 1941. *p.* 81
Electroplating processes create health hazards; chromium plating particularly serious; method of control by exhaust ventilation; new studies made on ventilation rate, tank width, etc.; equations; velocity contour curves; relation between center line velocity and distance outward from slot; the test manifolds; velocity distribution along slot for various test manifolds; design of exhaust manifold; recommended design for uniform distribution of flow, showing dimensions; references. (Discussion on p. 173, February; correction on p. 365, June.)

Production for National Defense—Two Years of Air Conditioning at the Allison Aircraft Engine Plant, by R. D. Tutt
Vol. 13, *No.* 10. *October*, 1941. *p.* 611
Description of air conditioning installations at Allison Div., General Motors Corp., Speedway, Ind.; expansion of plant; air conditioning capacity; mechanical refrigeration and well water used; centrifugal compressors and reciprocating compressors; air handling units; capillary air washers; electrostatic air filters; temperatures maintained; conditioning plant hospital; industrial exhaust; saving accomplished by taking air from dust arresters; method of handling heat treat areas; air distributed through orifice holes in floor; steam coils; roof ventilators; isolating degreasing and parts washing operations; maintenance and operation of system; operating costs; air conditioning the engineering building; reasons for air conditioning.

Production for National Defense—Ventilation of Plating Tanks, by Allen D. Brandt
Vol. 13, *No.* 7. *July*, 1941. *p.* 434
Health hazards of chromium plating; previous studies on ventilation of plating tanks; equations in use or suggested for determining ventilation rate; study undertaken to determine air flow characteristics of plating tanks provided with lateral exhaust ventilation, and minimum velocity necessary to maintain concentration of chromic acid mist below permissible safe limit; description of test set-up and method of making tests; ventilation characteristics; results of study with one hood; effect of slot width; ventilation with two hoods; comparison of minimum velocities over tank with one slot and with two slots; velocity contours for plating tank exhaust slot; references to other papers on the subject.

Protecting Factories Against Attack, by Arnold Kruckman
Vol. 13, *No.* 1. *January*, 1941. *p.* 16
Air conditioning of industrial plants considered one of the best protections against air attack; advantage of windowless construction; other protective features; duplicate pipe lines.

"Quoted"
Vol. 13, *No.* 12. *December*, 1941. *p.* 742
Air conditioning important in rehabilitation of Hotel Bentley, Alexandria, La., according to Coleman J. Hudson, manager of the hotel; average room occupancy increased.

"Quoted"
Vol. 13, *No.* 12. *December*, 1941. *p.* 742
Air conditioning playing important role in protecting parachutes against mildewing and rotting while in storage, according to Edward T. Murphy; five dehumidification units installed at naval air station.

"Quoted"
Vol. 13, *No.* 11. *November*, 1941. *p.* 687
All previous Chicago records for sale of central plant air conditioning and electric room coolers broken during first nine months of 1941; number of installations and horsepower; September, 1941, highest month in history in sales of both central systems and room coolers.

"Quoted"
Vol. 13, *No.* 11. *November*, 1941. *p.* 686
Brief description of air conditioning in the manufacture of beef bouillon cubes at Romanoff Caviar Co., New York City, by Edward T. Murphy; silica gel dehydrator gives direct control of humidity with mechanical compressor controlling temperature.

"Quoted"
Vol. 13, *No.* 12. *December*, 1941. *p.* 743
D. A. Newton advocates comprehensive survey of air conditioned buildings in New York City to uncover necessary and vital information in case of air attack; visualizes air conditioned cities of the future with arcades instead of sidewalks, all cooled from huge central stations; mass human comfort of the future will cost less than it does today; cost in large installations of the present is less than $15 a year per person.

"Quoted"
Vol. 13, *No.* 12. *December,* 1941. *p.* 743
Marked decrease in absentees from illness and elimination of closings on hot summer afternoons reported by Guarantee Mutual Life Co., Omaha, Neb., as result of air conditioning; operating costs of system reported to be 8c per yr per sq ft of space air conditioned.

"Quoted"
Vol. 13, *No.* 10. *October,* 1941. *p.* 630
New method of air conditioning in St. Francis hospital operating rooms, Poughkeepsie, N. Y., as described by Edward T. Murphy; air flows down walls and rises in middle of room around operating table.

"Quoted"
Vol. 13, *No.* 12. *December,* 1941. *p.* 742
Rapid growth of air conditioning has lead to improvement of cooling towers, according to L. T. Mart at semi-annual meeting of ASME; how air conditioning requirements affect cooling tower design; water requirements per ton of refrigeration.

"Quoted"
Vol. 13, *No.* 11. *November,* 1941. *p.* 687
Safety engineers can detect hazardous dusts, gases and fumes in industrial plants without delicate and precise measuring instruments, according to S. W. Gurney at National Safety Council meeting.

"Quoted"
Vol. 13, *No.* 10. *October,* 1941. *p.* 630
Susceptibility of man to weather conditions, a quotation from Royal F. Munger writing in the Chicago Daily News.

Reduces Errors
Vol. 13, *No.* 5. *May,* 1941. *p.* 310
Advantages of air conditioning Security National Bank at Greensboro, N. C., reported briefly by Edward T. Murphy.

Reducing Atmospheric Pollution
Vol. 13, *No.* 3. *March,* 1941. *p.* 150
Brief abstract of paper by R. V. Kleinschmidt and A. W. Anthony, Jr., on improved scrubbing methods for reducing atmospheric pollution due to industrial waste gases, fly ash and dust; recovery and use of sulphur dioxide.

Solar Heat Through Glass, by Lester T. Avery
Vol. 13, *No.* 12. *December,* 1941. *p.* 753
("Open for Discussion"); comment on short article by F. C. Houghten on solar heat gain through frosted and plain glass, published in September HPAC; frosted glass a better absorber of solar heat than clear glass.

Storage Tanks for Cooling Systems Where Compressor Capacity Is Less Than Load, by William Goodman
Vol. 13, *No.* 10. *October,* 1941. *p.* 631
Tabular data on compressor and storage capacities showing storage capacities in Btu per ton of load; method of using table for computing compressor size and storage tank required; typical examples solved; equations; the load factor; load variations; running time of compressor; required compressor and storage capacities for various operating periods of compressor; advantages of using a running period less than 24 hours.

There Ought to Be a Law
Vol. 13, *No.* 9. *September,* 1941. *p.* 575
Dr. Willis H. Carrier predicts that compulsory cooling legislation will be enacted in the not too distant future.

Tiffany & Co.'s New Air Conditioned Building, by Lester E. Kelley
Vol. 13, *No.* 9. *September,* 1941. *p.* 543
Zoned air conditioning system; avoiding air leakage problems and cross currents in main sales area; special ceiling grilles; recirculating booster heating systems; heating revolving doors; electrostatic air cleaners; tempering system for mezzanine; high velocity aspirating ceiling outlets; air conditioning the private offices and the other floors; the manufacturing floor; exhaust systems; toilet exhaust; location of mechanical equipment; 400 ton steam turbine driven centrifugal refrigerating compressor; unusual control hook-up; steam requirements supplied by New York Steam Corp.; the steam room; air for cooling towers taken from the building.

Tunnel Ventilation, by Ralph Smillie
Vol. 13, *No.* 1. *January,* 1941. *p.* 4
Description of design and construction of new Bankhead vehicular tunnel, Mobile, Ala.; ventilation system represents departure from previous practice; scheme of air flow; air exhaust; fans and drives; speed control; turning vanes; tunnel drainage.

Upping Efficiency With Air Conditioning, by Edward T. Murphy
Vol. 13, *No.* 9. *September,* 1941. *p.* 569
Blemishes in news picture negatives due to variations in developing temperatures eliminated in photo laboratories of Philadelphia Evening Bulletin by air conditioning; other advantages of air conditioning.

Ventilation for Electroplating, by J. M. DallaValle
Vol. 13, *No.* 3. *March,* 1941. *p.* 173
("Open for Discussion"); article New Data for Practical Design of Ventilation for Electroplating published in February HPAC a distinct contribution to the science of local exhaust ventilation.

Ventilation for Electroplating Tanks
Vol. 13, *No.* 6. *June,* 1941. *p.* 365
("Open for Discussion"); correction should be made in value of exponent used in equations given in article New Data for Practical Design of Ventilation for Electroplating, by William B. Battista, Theodore Hatch and Leonard Greenburg, published in February HPAC; a more complete form of the equation for determining the rate of ventilation for electroplating tanks; further experimental work required.

Water-Air Chart, The, by William Goodman
Vol. 13, *No.* 4. *April,* 1941. *p.* 221
(Part 1); graphical method for solving many problems dealing with exchange of heat between air and water; the water-air chart; explanation of its basis and its use; equations and tabular data for use with the chart; types of problems to which it is applicable; discussion of fundamentals of heat exchange between air and liquid; derivation of equations.

Water-Air Chart, The, by William Goodman
Vol. 13, *No.* 5. *May,* 1941. *p.* 291
Continuation of discussion of use of the water-air chart published on page 222, April HPAC; heating in parallel flow; cooling in parallel flow; heating in counterflow; cooling in counterflow; visualizing location of the *N*-lines.

Water-Air Chart, The, by William Goodman
Vol. 13, *No.* 6. *June,* 1941. *p.* 357
Explanation of methods of solving various problems with the water-air chart; formulas for solving problems involving evaporative condensers, with examples; sprayed cooling coil problems; surface temperatures of direct expansion cooling coils, counterflow cooling coils, and parallel flow cooling coils; method offers interesting possibilities for determining film coefficients.

Water-Air Chart, The, by William Goodman
Vol. 13, *No.* 7. *July,* 1941. *p.* 420
Use of the water-air chart as a psychrometric chart; drawing the lines of constant specific humidity; use of the chart for solving problems in counterflow and parallel flow heating with dry surface, and parallel flow and counterflow cooling with dry surface; slope of dew point lines on the chart; chart is universal in its application as it can be used for dry surface cooling, wet surface cooling, or cooling in which dry and wet surface both occur.

Why Do Insurance Companies Air Condition?, by H. L. Schwenker
Vol. 13, *No.* 3. *March,* 1941. *p.* 157
Home office building of Lincoln Liberty Life Insurance Co., Lincoln, Neb., remodeled; air conditioning installed; health improved; drafts eliminated; hay fever relief; loss of time from sickness reduced; air conditioning a good investment because of effect on personnel and effect on business machines; insurance offices are highly mechanized; brief description of the air conditioning system. (Discussion on p. 230, April.)

Why Should I Air Condition?
Vol. 13, *No.* 1. *January,* 1941. *p.* 35
Specific examples showing advantages of air conditioning in various industrial plants and commercial establishments; razor blades (Gillette Safety Razor Co., Boston); nylon hose (Archer Hosiery Mills, Columbus, Ga.); dry goods (Ely and Walker, St. Louis); bowling (Phoenix Bowling Center, Birmingham Ala.); buses (Bowen Trailways fleet); printing (Superior Decalcomania Co., Dallas); rugs (A. & M. Karagheusian, Inc., Freehold, N. J.); pig iron (blast furnaces at Woodward Iron Co., Woodward, Ala.); temperature and humidity conditions maintained and advantages of air conditioning for each of these applications.

General

Abbreviations for Engineering Terms
Vol. 13, *No.* 6. *June,* 1941. *p.* 346
Completion of revised American Standard Abbreviations for Scientific and Engineering Terms, Z10.1-1941; important changes in new standard; current usage the guide in deciding upon definitions.

Arsenal of Democracy—for the Conflict of Smokestacks
Vol. 13, *No.* 8. *August,* 1941. *p.* 478
Description of Indiana Ordnance Works, Charlestown, Ind., world's largest smokeless powder plant; size of project; site; supplying power and steam requirements; water requirements; piping services; heating; unit heaters; air conditioning installation in ballistics laboratory; heating the firing range; welded duct work for solvent recovery and drying; map showing distribution of sub-contractors and workers throughout U.S.A.

ASTM Committees Tell of Progress
Vol. 13, *No.* 5. *May,* 1941. *p.* 310
Committee on thermal insulating materials of the American Society for Testing Materials gives consideration to expansion of its activities; officers of the committee; work of the subcommittee on steel tubing and pipe; the coal and coke committee.

Civilian Defense in Time of War
Vol. 13, *No.* 2. *February,* 1941. *p.* 101
Committee appointed to assist war department in connection with protection of civilians and vital civilian installations in time of war; personnel; problems to be studied.

Coordinate Dimensions of Building Equipment
Vol. 13, *No.* 11. *November,* 1941. *p.* 676
Objectives and scope of project A62 of American Standards Association; advantages of standardizing building dimensions; brochure giving information on project.

Directory Section of Heating, Piping and Air Conditioning Equipment for Industry and Large Buildings
Vol. 13, *No.* 1. *January,* 1941. *p.* 203 (*back section*)
Products classified, trade names and complete street addresses of manufacturers.

Engineering Training for Defense
Vol. 13, *No.* 6. *June,* 1941. *p.* 346
New classes for engineering training for defense held at Northwestern Technological Institute; purpose of the ventilation and air conditioning course.

Financing the Defense Program
Vol. 13, *No.* 1. *January,* 1941. *p.* 3
Comments of Harold G. Moulton, president of Brookings Institute, on financing the national defense program; possible to maintain fiscal stability.

Housing and National Defense
Vol. 13, *No.* 1. *January,* 1941. *p.* 188 (*back section*)
Excerpts from address made by Charles F. Palmer, national defense housing coördinator, before the Metropolitan Housing Council, Chicago; method of approach to the emergency problem of housing defense workers; the defense housing need; trend toward shifting tax burden from real estate to personal and corporate incomes; slum clearance and its importance in defense; the problem of post-war collapse.

Industrial Research a Natural Resource
Vol. 13, *No.* 8. *August,* 1941. *p.* 496
Industrial research is one of America's greatest natural resources, according to E. R. Williams; examples of "modern miracles" turned out by research laboratories; research in the petroleum field; insulation of heated equipment; future of America depends upon the type of industrial thinking we have.

Pre-Employment Examinations, by Yale Rosenfeld
Vol. 13, *No.* 11. *November,* 1941. *p.* 692
("Open for Discussion"); comment on article on industrial health hazards, by Lawrence R. Bloomenthal published in September HPAC; importance of educating employer adequately to use of safeguards; necessity of pre-employment physical examinations; supposedly cured tubercular individual develops recurrence of illness due to dust exposure.

Priorities Picture, The . . . News of Recent Priority Orders Which Affect Heating, Piping and Air Conditioning
Vol. 13, *No.* 12. *December,* 1941. *p.* 747
Preparation for allocation of all critical materials throughout American industry called for by Supply Priorities and Allocations Board and Office of Production Management; information released by OPM to guide applicants for project preference ratings in various utility fields, including central heating; restrictions against use of copper sheet, strip and screen in building construction eased somewhat; amendments to defense housing critical list announced; oil burners restored to good standing in defense housing construction on eastern seaboard; new repair and maintenance order for iron and steel industry provides basic preference rating of A-3 for essential repair, maintenance and operating material, and higher ratings for emergencies; Supply Priorities and Allocations Board rules that priority ratings will not be issued for construction of proposed national defense pipe line for supplying oil to eastern seaboard region; preference rating granted to manufacturers of essential fire fighting apparatus; preference rating order P-62 assigns rating of A-5 to manufacturers of laboratory chemicals and equipment.

"Quoted"
Vol. 13, *No.* 12. *December,* 1941. *p.* 742
General Electric Co. has new committee whose slogan is "Anything over 10 years old may be obsolete" according to Stuart M. Crocker, vice-president; aim of committee is to streamline the company for the job ahead during the post-war period.

Reference List of Priority Orders
Vol. 13, *No.* 11. *November,* 1941. *p.* 701
(HPAC data sheet); latest available list of P series and M series priority orders of the Office of Production Management.

War Department Appoints Specialists
Vol. 13, *No.* 4. *April,* 1941. *p.* 238
Several more consultants and specialists in design and engineering appointed to staff of construction division, office of quartermaster general; their names and assignments.

Water for Industrial Uses
Vol. 13, *No.* 8. *August,* 1941. *p.* 491
Activities of American Society for Testing Materials in developing standards for methods of sampling water for industrial purposes; papers presented at recent ASTM meeting.

Heating

Additional Research on Panel Heating Needed, by J. H. Walker
Vol. 13, *No.* 12. *December,* 1941. *p.* 751
("Open for Discussion"); importance of clarifying definitions and terminology in panel or radiant heating; panel heater does not ordinarily heat entirely by radiation; are there any benefits in lower air temperatures maintained?; effect of radiant heating upon metabolism; panel heating should be compared with best practice in other fields, not with worst; panel heating has advantages in special applications; danger of overexploiting panel heating.

Are Radiators Necessary in Air Conditioned Buildings?, by Samuel R. Lewis
Vol. 13, *No.* 11. *November,* 1941. *p.* 680
(Answer to a reader's question); why will not bidders guarantee winter comfort conditions unless direct radiators are left under windows in air conditioned offices?; several experiences in various buildings cited; large windows in bank space; continual complaint in large general offices where system was of the all indirect type; use of radiators or local convectors recommended.

Are Radiators Necessary in Air Conditioned Buildings?
Vol. 13, *No.* 12. *December,* 1941. *p.* 749
Comment of W. C. Heimbeck and M. Ehrlich on use of direct radiators in air conditioned Harvester building; operation with and without radiators; importance of preventing downdrafts near windows; radiators a necessity; additional comment on subject by Samuel R. Lewis; radiators necessary in air conditioned buildings which have windows, and where air delivery temperature to individual rooms is not varied automatically and simultaneously to meet the requirement of each separate room; method of air introduction; advantages of low velocity diffusers, double windows, and possibly panel type radiation.

Birmingham "Swats the Smoke," by George H. Watson
Vol. 13, *No.* 9. *September,* 1941. *p.* 548
Results of first year of smoke abatement campaign in Birmingham, Ala.; underfeed stokers installed; overfire steam jets; test on advantages of chemically treated coal at housing project; overfire blower equipment installed in central steam plant; description of installation; educational activities of smoke abatement inspector.

Conservation for National Defense—Fuel Economy in Oil Fired Plants, by Kalman Steiner
Vol. 13, *No.* 8. *August,* 1941. *p.* 481
Importance of conserving fuel; methods of making economies in steam generation; five considerations involved; recommendations for improving efficiency of oil pumps, oil heaters, and instruments and controls; maintenance of nozzles or atomizers; the combustion chamber; how heat is lost; refractories; air flow through boiler; draft control; keep boilers clean; water treatment.

Conservation for National Defense—How to Cut Heating Cost, by E. A. Tyler
Vol. 13, *No.* 11. *November,* 1941. *p.* 673
Control system at First National Bank Bldg., St. Paul, Minn., on two pipe vacuum heating installation; control pays; checking temperatures; pressure operating chart; forms for recording daily and monthly steam consumption and heat complaints; electric resistance thermometer for checking inside and outside temperatures; control primarily designed for industrial heat applications adapted to building; results of steam conservation program; steam consumption for space heating; comfort improved; heating a cold arcade; warm air from building exhausted to garage to reduce garage heating cost.

Conservation for National Defense—How to Save Heating Fuel, by E. A. Tyler
Vol. 13, *No.* 10. *October,* 1941. *p.* 635
Importance of using fuel and steam economically and efficiently; initial steps taken to reduce steam consumption for heating First National Bank Bldg. at St. Paul, Minn.; advantages of degree days; five phases involved in getting started on a steam conservation program; stopping the leaks of warm air from the building; infiltration in tall buildings; loss of warm air through skylights and poorly fitting penthouse doors; elevator shafts; other losses; importance of locking windows at night; shutting off steam at night; steam shut-off chart established for various outside temperatures; correcting unbalanced radiation; undersize riser cross connected with oversize riser in northeast corner of building.

Conservation for National Defense—There Is No Substitute for Fuel, by Kalman Steiner
Vol. 13, *No.* 9. *September,* 1941. *p.* 573
Importance of conserving fuel; heating plants need a speedometer as they are inherently wasteful; importance of good control; defects that may show up in heating system when they are put under automatic control; methods of reducing amount of heat needed.

Construction Details for Radiant Heating and Cooling, by T. Napier Adlam
Vol. 13, *No.* 7. *July,* 1941. *p.* 431
Special radiant heating and cooling panels installed in classroom at new Northwestern Technological Institute, Evanston, Ill.; studies to be made; installation comprises floor coils and panels in two walls and in ceiling; wrought iron pipe; drawings give details of panels, method of supporting and hanging them, and method of installing insulation; automatic control maintains correct water temperature circulated through the coils, according to outside weather conditions.

Construction for Defense—Central Steam Heating Plant for Army Camp Hospital, by Frederick W. Bull and H. King McCain
Vol. 13, *No.* 5. *May,* 1941. *p.* 279
Steam heated hospital group at Camp Wheeler, Macon, Ga.; buildings of standard army design; direct cast iron radiation and unit heaters; boiler house; steam mains run in covered walkways; return lines; steam pressures; pitch; welding facilitates job; expansion joints; anchoring piping; fibrous glass insulation.

Correction Chart for Draft Readings, by B. H. Jennings
Vol. 13, *No.* 10. *October,* 1941. *p.* 625
(HPAC data sheet); draft-loss correction chart based on 70 F air and flue gas 4 per cent heavier than air; explanation of its use; example showing use; importance of making corrections in draft gage readings.

Daily Degree Day Check Saves Heating System, by R. E. Hieronymus
Vol. 13, *No.* 1. *January,* 1941. *p.* 9
Importance of daily checks as compared with monthly checks; use of the Erlenborne chart; results achieved in a Chicago office building; average temperatures in building after heating economy program was well under way; tenant complaints; steam for heating water; who should keep the chart; method has wide application; (also see first part of article published in December, 1940, HPAC).

District Heating Men Meet, by G. D. Winans
Vol. 13, *No.* 7. *July,* 1941. *p.* 410
Review of the highlights of the National District Heating Association's annual meeting; district heating business during 1940; review of reports and papers presented; intermittent heating; principles of economic heating; zoning; steam pip-

ing; meter testing; steam generation and use in institutional building groups; steam jet cooling; trap maintenance; radiant heating; degree day base; other reports; new officers.

Expand the Use of Fuel Oil, by Kalman Steiner
Vol. 13, *No.* 7. *July,* 1941. *p.* 417
Discussion of fuel oil situation caused by transfer of tankers supplying Atlantic Seaboard; United States produces 65 per cent of world's petroleum supply; the transportation shortage; abundant stocks to serve our needs; reducing fuel oil consumption; war on waste instituted by Oil Burner Institute; the nation's fuel requirements; impossibility of replacing fuel oil with coal or gas; pipe lines and barges; reasons for giving favorable consideration to increasing use of fuel oil; how to coöperate in conserving fuel. (Discussion on p. 497, August, and p. 560, September).

Figuring the Building Volume for Fuel Consumption Studies, by R. E. Hieronymus
Vol. 13, *No.* 9. *September,* 1941. *p.* 549
How to choose the proper building volume figure to use in recording steam or fuel consumption; various methods of computing building volume.

Fuel Oil, by H. A. Gilbert
Vol. 13, *No.* 9. *September,* 1941. *p.* 560
("Open for Discussion"); comment on article by Kalman Steiner discussing the fuel oil situation, published in July HPAC.

Fuel Oil Situation on the Atlantic Seaboard, The, by L. W. Mauger
Vol. 13, *No.* 8. *August,* 1941. *p.* 497
("Open for Discussion"); comment on article on the fuel oil situation by Kalman Steiner, published in July, 1941, HPAC; effect of transferring tankers to Great Britain on the available supply on the Atlantic Seaboard; distinct possibility of shortage during 1941-1942; fuel oil contracts and prices; if rationing should occur, some yardstick of efficiency should be used; is fuel oil a byproduct of gasoline manufacture?; converting boilers to burn coal; (reply by Mr. Steiner).

Fuel Oil System Supplements Gas
Vol. 13, *No.* 3. *March,* 1941. *p.* 153
Heavy fuel oil system being installed at plants of Timken Roller Bearing Co. for use in case of possible failure of natural gas supply; modernization program undertaken to prevent interruption of defense work.

Gas Fired Units Solve Many Industrial Heating Problems, by W. N. Blinks
Vol. 13, *No.* 4. *April,* 1941. *p.* 217
Excerpts from talk made at conference on industrial gas sales of American Gas Association; value of gas fired unit heaters in low temperature drying, spring and fall heating of office space, and heating departments which run long hours per day; improving plant working conditions; heating temporary buildings; protecting storage rooms against freezing; controlling humidity; trend toward higher temperatures in plants; importance of controlling temperatures; spot heating in plants.

Giant Plants Build Giant Planes
Vol. 13, *No.* 11. *November,* 1941. *p.* 688
Description of heating and ventilating the new Boeing Aircraft Co. plant at Seattle for manufacture and assembly of Flying Fortresses; 42 miles of piping; sprinkler system; underground passages and tunnels for utility lines; heating and ventilating the executive office building, engineering building, assembly sections, warehouses and miscellaneous buildings; heating and ventilating underground washrooms; unit heaters; exhaust systems; five oil burning boilers.

Heat Flow Problems Solved by Electrical Circuits, by Victor Paschkis
Vol. 13, *No.* 12. *December,* 1941. *p.* 756
Transient or intermittent heat flow problems difficult to solve by mathematical analysis or experiment; solution simplified by analogy with electrical circuits; method of setting up an electrical circuit to study heat flow problems; laboratory at school of engineering of Columbia University; analysis of heat flow through wall by electrical model method; various types of problems that can be solved by method; transient heat flow phenomena in mines and air raid shelters; studies of pipe insulation; references on subject.

Heating a Drafting Board 750 Ft Long by 90 Ft Wide, by C. W. Kimball
Vol. 13, *No.* 6. *June,* 1941. *p.* 351
Unit heaters adopted for heating new mold loft at shipyard of Bath Iron Works, Hardings Siding, Bath, Me.; use of a mold loft; size; seven horizontal centrifugal fan unit heaters installed in trusses; air circulation; size of units.

Heating and Ventilating Up in the Air, by W. W. Davies
Vol. 13, *No.* 1. *January,* 1941. *p.* 6
Description of heating, ventilation and automatic temperature control on commercial air liner; ventilation of airplanes; ventilation rate; individual ventilation; humidity; importance of heating; descriptions of hot air heating system, steam heating system, and liquid heating system; automatic temperature control; recent development is an automatic temperature controller employing mercury column type of temperature sensitive elements.

Heating the Washington Monument, by Charles S. Stock
Vol. 13, *No.* 6. *June,* 1941. *p.* 343
Contract awarded for heating system for Washington national monument, Washington, D. C., in order to protect steelwork from deterioration due to condensation and improve comfort and safety; unusual problem in design; updraft due to stack effect; figuring heat loss; design basis used; unit heaters selected; installation of units; control; safety precautions.

Hot Water Heating System Design, by F. E. Giesecke
Vol. 13, *No.* 8. *August,* 1941. *p.* 485
(HPAC data sheet); new data on friction head in pipe and fittings; friction head in milinches per foot of pipe for various water flows and pipe sizes; friction head in milinches per 90 deg screwed elbow; heat conveyed per hour for temperature difference of 20 F; table of elbow equivalents, showing relative resistances in number of elbow equivalents for various fittings and items of equipment.

How Big Is a Boiler?, by Robert K. Thulman
Vol. 13, *No.* 1. *January,* 1941. *p.* 42
("Open for Discussion"); comment on article by Kalman Steiner and Fred Ravnsbeck published in October, 1940, HPAC; importance of boiler ratings; any basis of rating other than that determined by an established test procedure tends to stifle initiative in design and encourage production of poor equipment; nozzle output of heating boiler.

How to Save Heating Dollars, by H. P. Scott
Vol. 13, *No.* 4. *April,* 1941. *p.* 239
Methods of reducing heat requirements of buildings; recommendations; sectionalizing piping; air eliminators; circulators and vacuum pumps; controls; soot removing compounds; feedwater treatment; tube cleaners; sludge solvents; draft controls; gages, meters and thermometers; several examples of how fuel requirements have been reduced in various buildings—apartments, office buildings, loft buildings.

Increases Production
Vol. 13, *No.* 3. *March,* 1941. *p.* 153
New plant of Square D Co., Milwaukee, Wis.; thermostatically controlled ceiling projection type unit heaters; oil burning boilers; separate boiler for process steam; new square duct used for electric wiring; underground oil storage tanks; air conditioning units for office section; 50 F water from deep well; standing pond on office roof reduces cooling load.

Likes Panel Heating, by Dan H. Wallace, Jr.
Vol. 13, *No.* 12. *December,* 1941. *p.* 751
("Open for Discussion"); comment on F. W. Hutchinson's article on panel heating in October HPAC; experience with panel heating installation in office building of Greenville Steel and Foundry Co.; wrought iron pipe coils in floor; health and comfort of employees improved.

Method for Reducing Fuel Consumption, A, by H. P. Scott
Vol. 13, *No.* 3. *March,* 1941. *p.* 163
Importance of a method of checking fuel consumption frequently during the heating season rather than during the summer; system must be comparatively simple; recording consumption of oil, gas, coal and street steam; importance of frequent reports; setting up theoretical ideal of fuel consumption; study of fuel consumption over six year period for 250 buildings; consumption of steam, oil and coal for heating lofts, offices and apartments on cu ft per season and 1000 cu ft per degree day bases; fuel oil consumption for apartments during the heating season in New York City, with percentages of consumption each month; forecasting fuel consumption; correction factors for exposures of buildings; results achieved in reducing fuel consumption; importance of segregating fuel consumption for heating hot water.

New Heat Loss Factors, by S. Konzo
Vol. 13, *No.* 12. *December,* 1941. *p.* 761
(HPAC data sheet); method of estimating heat loss that is not only strictly precise but is also a shortcut announced by research staff at University of Illinois; heat loss factors presented for 105 different types of construction; advantages of new coefficients; to be incorporated in all codes of the National Warm Air Heating and Air Conditioning Association.

Organization for Defense Heating
Vol. 13, *No.* 2. *February,* 1941. *p.* 86
Example of need for operations management in installing cantonment heating is the contract for forced warm air systems at Camp Custer, Mich.; number of furnaces and duct systems installed; typical system in 63 man, two story barracks; organization of the field forces; drilling blower anchor bolts; duct work crews; furnace room crews; smoke stacks; breeching; controls: engineer employed as coördinator; table showing types of buildings and Btu, cfm, static pressure and blower and motor requirements.

Panel Heating, by Carl F. Boester
Vol. 13, *No.* 2. *February,* 1941. *p.* 102
("Open for Discussion"); brief explanation of fundamentals of panel or radiant heating; importance of control of room surface temperatures; panels should have low thermal capacity; one type of panel made by casting small diameter, thin wall copper tubes in insulating material; no system is better than its controls; panel cooling for summer comfort.

Panel Heating Throughout the World, by F. W. Hutchinson
Vol. 13, *No.* 2. *February,* 1941. *p.* 96
Extent of panel heating installations in various countries; number of panel warming installations (Crittall patents) installed in various countries to 1938 classified according to types of buildings; temperature gradient with panel heating; value of panel heating in banks and churches; reasons for using panel heating in factories, in hospitals and schools, and in stores and offices; why panel heating is not more widely applied in residences; why use of panel heating in United States has been relatively limited to date.

"Quoted"
Vol. 13, *No.* 11. *November,* 1941. *p.* 686
Reasons for failure of smoke campaigns, as outlined by T. A. Marsh at the fall meeting of the ASME.

Radiant and Convection Heating Combined in Garden Apartments, by G. F. Nightingale
Vol. 13, *No.* 9. *September,* 1941. *p.* 555
Description of River Forest Garden Apartments, River Forest, Ill.; method of combining radiant and convection heating; central boiler plant serves all buildings with hot water; varying the water temperature; panel heat surfaces formed by

ducts from air conditioning unit; questionnaire gives tenant reactions to method of heating; do ceiling air diffusers cause drafts?

Radiant Heating
Vol. 13, *No.* 5. *May,* 1941. *p.* 294
Comment by Carl F. Boester on article by F. W. Hutchinson in April HPAC; importance of responsiveness to control and flexibility of operation in panel heating systems.

Radiant Heating and Cooling
Vol. 13, *No.* 8. *August,* 1941. *p.* 501
Correction of error in article on radiant heating and cooling on p. 589, October, 1940, HPAC.

Radiant Heating Job Pictured, by T. Napier Adlam
Vol. 13, *No.* 6. *June,* 1941. *p.* 352
Radiant heating installation comprising pipes embedded in floors at Greenville Steel & Foundry Co., Greenville, S. C.; layout of wrought iron pipe coils in first and second floors; hot water the heating medium; method of control of hot water temperature in accordance with outside air temperature; importance of air elimination; photographs showing construction of first and second floor coils.

Radiant Heating With Cast Iron Panels, by T. Napier Adlam
Vol. 13, *No.* 5. *May,* 1941. *p.* 300
("Open for Discussion"); comment on article on radiant heating by means of cast iron panels by F. W. Hutchinson, published in April HPAC; the first cast iron panels installed in America; radiant heat panels in plant offices; reasons for using radiant heat in powder manufacturing plants; radiant heating calculations; capacity of floor and ceiling panels compared; reply to Mr. Adlam's comments by F. W. Hutchinson.

Radiant Heating—With Cast Iron Panels, by F. W. Hutchinson
Vol. 13, *No.* 4. *April,* 1941. *p.* 231
Discussion of radiant heating by means of cast iron panels; characteristic features of this method; effect of the higher surface temperature used; capacity of the panels; method of sizing; several types and their construction; extent of application; not competitive with low temperature radiant heating methods; illustrations of applications of these panels; insulation. (Discussion on pp. 294 and 300, May.)

Round House Heating Costs Cut
Vol. 13, *No.* 8. *August,* 1941. *p.* 484
East Buffalo round house of Lehigh Valley Railroad modernized; low pressure boilers replace high pressure boilers; 40 unit heaters installed; method of installing units to heat pit stalls; annual savings.

Smoke Gets in Your Eyes
Vol. 13, *No.* 1. *January,* 1941. *p.* 23
Report of a series of smoke determinations and efficiency tests made on stoker fired boiler installation at New York University; description of the installation; setting height; results of tests; discussion of results; effect of excess air on smoke density.

South American Way on This Buenos Aires Job Was to Use a Heat Pump, by Melvin A. Ramsey
Vol. 13, *No.* 3. *March,* 1941. *p.* 167
Factors governing economic advantages of heat pump or reversed refrigeration cycle installations for heating buildings; example of such an installation in 700 seat motion picture theater in Buenos Aires; climatic conditions; 64 to 68 F well water available; improving load factor; details of the installation—compressor, condenser, evaporator, counterflow water coil; method of control and change-over from summer to winter operation; schematic diagram of installation; hours and kilowatthours for heating and cooling for nine months' operation.

Specification Short-Cuts
Vol. 13. *No.* 12. *December,* 1941. *p.* 758
Top specification men in government agencies simplify specification writing; work is an outgrowth of streamlined specification system devised by Horace W. Peaslee; system concentrates in single control clause all usual mandatory clauses; system used by Veterans Administration; typical excerpts from a Veterans Administration heating specification.

Steam or Hot Water for Process Heating?, by Samuel R. Lewis
Vol. 13, *No.* 3. *March,* 1941. *p.* 173
("Open for Discussion"); answer to question by reader on relative merits of steam and high pressure hot water in process heating from the aspects of temperature control and economy; advantages of using water for this service.

Step in Reverse, A, by Will D. Sampson
Vol. 13, *No.* 11. *November,* 1941. *p.* 692
("Open for Discussion"); panel heating a definite step in reverse; objections to panel cooling; year around air conditioning should be used.

Test for Oil, by S. D. Distelhorst
Vol. 13, *No.* 12. *December,* 1941. *p.* 760
Helpful preliminary test for determination of oil in boiler feedwater.

Unit Heaters . . . Direct Radiation . . . Zone Controlled
Vol. 13, *No.* 9. *September,* 1941. *p.* 576
Brief description of one pipe, zoned, forced circulation hot water heating system in new Bell & Gossett plant, Morton Grove, Ill.; the various zones allow different temperatures to be maintained; several types of unit heaters and direct radiation used; panel heating with pipe coils in the floor provided in some departments; method of control; automatically fired steam boilers.

Use of Heavy Oil in Today's Boiler Plant, The, by Paul R. Unger
Vol. 13, *No.* 1. *January,* 1941. *p.* 32
General discussion of modern methods of burning heavier fuel oils; keeping the oil warm; various methods of heating the oil; piping layout; oil pumping, heating, straining and metering sets; oil burner control; eliminating puffs; draft control; six essential safeguards; use of photo-electric cell in guarding against flame failure; illustrations showing method of enclosing all controls in a compact cabinet box; use of new square duct for electrical wiring between control panels and burners.

Why Draft Gage Readings on Boiler Furnaces Sometimes Seem Incorrect, by B. H. Jennings
Vol. 13, *No.* 10. *October,* 1941. *p.* 622
Discrepancies in pressure readings when testing boiler furnaces and gas heat transfer equipment; draft gage readings; cause of errors; explanation of effect of altitude on pressure readings; altitude-pressure graph for 59 F air; pressure-elevation graph for 70 F air and 330 F flue gas.

Why Panel Heating?, by T. Napier Adlam
Vol. 13, *No.* 11. *November,* 1941. *p.* 690
("Open for Discussion"); comment on article by F. W. Hutchinson, published in October HPAC; advantages of radiant heating; equal comfort conditions with lower air temperature; relative humidity; metabolism at lower air temperatures.

Why Panel Heating?, by F. W. Hutchinson
Vol. 13, *No.* 10. *October,* 1941. *p.* 620
("Open for Discussion"); intangible advantages of panel heating; effect of lower air temperature on relative humidity indoors; improvement in relative humidity slight in cold weather and more pronounced with moderate outside temperatures; inside air temperature; effect of shock; ion content of air; freshness of air in panel heated structures. (Comment on p. 690, November and p. 751, December.)

Why Panel Heating?, by J. H. Walker
Vol. 13, *No.* 9. *September,* 1941. *p.* 560
("Open for Discussion"); why is panel heating enjoying wide popularity?; need for a demonstration of its real advantages before too much effort is "wasted" upon its study. (Comment on p. 620, October, pp. 690 and 692, November, and pp. 750 and 751, December.)

Why Panel Heating?—An Experience Report, by H. F. Randolph
Vol. 13, *No.* 12. *December,* 1941. *p.* 750
("Open for Discussion"); comment on letter on panel heating by J. H. Walker published in September HPAC; experience with three installations employing ceiling panels for panel heating; uniformity of temperature; constancy of temperature; greater comfort due to warm floors; cleanliness and appearance; temperature readings at various times of day under various conditions.

Piping

Check Piping for Savings, by R. S. Hawley
Vol. 13, *No.* 7. *July,* 1941. *p.* 419
Excerpt from paper presented at Midwest power conference; survey made in plant to determine losses; condensate loss reduced by repairing traps, overhauling valves, and checking drain lines; leaks in heating coils; two large coils found discharging into sewer; make-up water for boiler feed reduced from approximately 60 to less than 40 per cent.

Check Weak Spots in Piping Layout to Avoid Shutdowns, by A. C. Kirkwood
Vol. 13, *No.* 11. *November,* 1941. *p.* 679
Importance of preventive maintenance for full-time production; survey of weak spots in an industrial plant piping layout; seats and discs on gate valves cutting out on steam supply lines to pressure cookers; leaking gaskets on steam lines to engines; leaking threaded joints in high temperature steam lines; corrosion in hydrochloric acid lines; recommendations for preventing the above troubles.

Condensation in Compressed Air Piping, by G. M. Brown
Vol. 13, *No.* 9. *September,* 1941. *p.* 577
(HPAC data sheet); chart showing the water vapor in compressed air at various temperatures and pressures; example of use of chart; desirable features of a compressed air piping system to avoid troubles from condensation.

Flow in Piping, by William Goodman
Vol. 13, *No.* 3. *March,* 1941. *p.* 155
(HPAC data sheet); universal flow chart for solving problems involving the flow of any fluid in pipe lines, whether liquid or gas; equation for determining Reynolds' number; method of finding pressure drop or pipe size; method of finding rate of flow through pipe line.

Gasketed Joints for High Pressure, High Temperature Piping Service, by Arthur McCutchan
Vol. 13, *No.* 7. *July,* 1941. *p.* 423
Importance of heavy flanges and bolting; analysis of effect of a bending moment acting on two typical flanged joints, one using 1500 lb and the other 900 lb flanges of the American Standard ASA B16e; minimum bolt force to prevent leakage with composition asbestos gaskets and serrated metal gaskets; joint efficiency; application of a serrated metal gasket to a modified 900 lb flanged joint; use of gas filled tubular gaskets; indentation caused by narrow metal gasket; effect of water on one side of steam joint; leakage in low pressure condensate lines; breakage of welded heating header; leakage of water at spring compensated joints in 1000 F steam line; water accumulation cause of trouble; analogy with heated bar; bending moment caused by temperature difference; experience with a ring joint; test showing load on flanges at which gasket leakage occurs.

Heating Compressed Air Piping, by Lee P. Hynes
Vol. 13, *No.* 2. *February*, 1941. *p.* 106
Need for heating compressed air lines or reservoirs; example is application of compressed air lines for air bubbler systems for preventing ice formation on hydraulic structures; reason for heating; study made by D. F. McFarland; air pressure; design and installation of the heating equipment.

High Pressure Piping at Millers Ford, by R. D. Gillespie and J. D. Williamson
Vol. 13, *No.* 6. *June*, 1941. *p.* 354
Opportunity offered by installation of 1200 psi, 900 F units at Millers Ford Station of Dayton Power & Light Co. to study changes in high pressure, high temperature steam piping over the three year period 1937-1940; specifications for the two installations; the pipe; castings; details of welds; method of welding; preheating; stress relieving; expansion loops; valves; motor drives for gate valves; bolted joints; actual test results on pressure drop in 12 in. turbine lead.

High Temperature Piping
Vol. 13, *No.* 11. *November*, 1941. *p.* 681
Brief abstract of paper by H. L. Solberg, G. A. Hawkins and A. A. Potter presented at ASME meeting reporting investigation of corrosion by steam of the various steels available for high temperature service; resistance of alloy steels greatly influenced by amount of chromium.

How to Make Mitered Pipe Joints, by W. D. Scheffey
Vol. 13, *No.* 11. *November*, 1941. *p.* 704
Easy method of marking correct line of cut on pipe when making mitered joints for pipe elbows; formula to use when making bend consisting of more than two sections.

Identifying Piping Services
Vol. 13, *No.* 4. *April*, 1941. *p.* 241
(HPAC data sheet); importance of identifying piping services in plants and buildings; classification of materials carried in pipes and recommended sizes of stencil letters as given in the American Recommended Practice Scheme for Identification of Piping Systems; principal requirements for a standard scheme; schemes worked out to meet the particular requirements of various buildings; color codes used at an aircraft factory, a rubber industry plant and a public building.

Identifying Your Mechanical Equipment Simplifies Operation and Maintenance
Vol. 13, *No.* 3. *March*, 1941. *p.* 151
Scheme of marking and identifying apparatus at Museum of Science and Industry, Chicago; advantages; method of marking various equipment, including starter cabinets, ducts, controls, pumps, etc.; diagrams of systems and circuits posted with apparatus; piping systems identified by color code; color combinations used for the various piping services.

Industry's Greatest Transportation System, by S. J. Paradiso
Vol. 13, *No.* 10. *October*, 1941. *p.* 627
Improved process piping aids distilling at Louisville plant of Calvert Distilling Co.; rigid control essential; wide sweep fittings and connections to eliminate pockets; scheme of identifying piping; cleanliness vital; use of copper piping and alloy steel; dairy type pipe line; elaborate automatic control system; free flow in piping essential; stainless steel tubing; heat exchangers.

Installation Requirements for Head Meters, by Howard S. Bean
Vol. 13, *No.* 12. *December*, 1941. *p.* 744
Summary of test data on effects of installation conditions on head meters; lengths of straight pipe which should precede the differential producer; sketches showing various piping arrangements considered; how to use plotted data; recommendations for fuel gas piping and power piping; valve installation; orifices vs. nozzles as differential producers; sources of data.

Instruments and Controls Increase Output
Vol. 13, *No.* 5. *May*, 1941. *p.* 306
Excerpts from paper by Charles W. Parsons presented at Midwest Power Conference; savings made by increasing per cent of CO_2 in flue gas; how combustion meters lead to economies; how steam flow meters can be used to make savings; important steam flows to be metered; advantages of metering steam to various plant departments.

Insulation of Chilled Water Piping, by Jake Stahl
Vol. 13, *No.* 9. *September*, 1941. *p.* 554
Method of using cork insulation at hangers and wool felt insulation between on chilled water lines at Merchandise Mart, Chicago; details of the application; practice at the Mart in insulating fan housings with cork; duct insulation.

Interchange of Power and Steam, by W. A. Hanley
Vol. 13, *No.* 10. *October*, 1941. *p.* 634
Comment on article by P. W. Ross on interchange of power and steam published in September HPAC; inherent savings in an arrangement of this kind.

Interchange of Power and Steam, by P. W. Ross
Vol. 13, *No.* 9. *September*, 1941. *p.* 552
Excerpts from paper presented at Midwest Power Conference; reasons for interchanging power and steam between public utility and industrial plants; revenue to utility; high pressure steam line; safety shut-off valve; customers added to line; method of combining steam and electric billing; steam headers between two plants tied together. (Comment on p. 634, October.)

Intricate Piping Is Needed for Fluorescent Lamp Manufacture, by O. R. Wollentin
Vol. 13, *No.* 8. *August*, 1941. *p.* 499
Description of new fluorescent lamp plant of Westinghouse Electric & Mfg. Co., Fairmont, W. Va.; natural gas for heating and for burners on lamp making machinery; gas fired unit heaters; gas piping; compressed air piping; oxygen piping; pressure regulation; argon and hydrogen services; check line for testing quality of gas used in manufacture; copper tubing used for argon lines especially treated; 55 F mine water used for cooling; mine water cools circulating water in heat exchanger; welded piping; all air electrostatically cleaned; sterilizing lamps destroy bacteria; plant is windowless, primarily to keep out dust and dirt; zone control.

Models Solve Piping Problems
Vol. 13, *No.* 2. *February*, 1941. *p.* 95
Mechanical method for solving problems involving stresses and reactions in steam plant piping briefly described; value of method; picture showing model set-up of three dimensional pipe run.

Paint Distribution Piping Improves Production
Vol. 13, *No.* 11. *November*, 1941. *p.* 699
Description of new centralized paint storage and mixing, with nine pipe circulating system, at Berger Mfg. Div., Republic Steel Corp., Canton, Ohio; advantages; mixing rooms; piping installation; tanks are mechanically agitated; electric motor and air motor driven pumps used; pipe line filters; maintaining uniform operating pressure.

Piping for Packaging
Vol. 13, *No.* 4. *April*, 1941. *p.* 228
New bottling department of F & M Schaefer Brewing Co., Brooklyn, N. Y.; beer is conveyed in nickel tubing; use of nickel piping avoids emptying pipe line each night; method of cleaning pipe line; nickel alloy regulating valves.

Piping Rides on Roller Bearings
Vol. 13, *No.* 4. *April*, 1941. *p.* 238
Tapered roller bearing conveyor tubes used as supports for hot water and steam lines at plants of American Viscose Corp.; description of supports and their advantages.

Plan for Piping Maintenance, by A. C. Kirkwood
Vol. 13, *No.* 1. *January*, 1941. *p.* 1
Schedule of preventive maintenance prepared so that army defense orders won't be delayed in an industrial plant; procedure for piping inspection and maintenance; inspection while lines and equipment are in operation—joints, valves, hangers and anchors, insulation and painting; inspection and repair when piping or equipment is out of service—joints, valves, operators and controls; alignment and supports; repairing valves.

Power Piping Welding, by Philip Salmon
Vol. 13, *No.* 2. *February*, 1941. *p.* 93
Power piping welding at Burlington Generating Station; cellulose coated rod used for both carbon moly and carbon steel; joint details, with sketches showing dimensions; use of socket type joints; stress relieving; shrinkage of welds observed; welded valves; use of weld prober; position welds; qualifying welders.

Pressure Storage Vessels
Vol. 13, *No.* 3. *March*, 1941. *p.* 153
Brief abstract of paper presented by Merl D. Creech describing research undertaken on use of rupture disks for preventing explosions of industrial pressure storage vessels; air receivers an example.

Production for National Defense—Piping Design, by William Goodman
Vol. 13, *No.* 3. *March*, 1941. *p.* 145
Flow of gases and vapors in piping with large pressure drops; use of universal flow chart in facilitating solution of problems; determining the pressure drop; determining pipe size; rate of flow; Reynolds' number; critical pressures and maximum flow; curves showing friction factors for various Reynolds' numbers; use of "final equivalent pressure"; examples showing method of solving typical problems in flow of steam, air and ammonia.

Proper Operation at Minimum Cost If Piping Layout Is the Right One, by A. C. Kirkwood
Vol. 13, *No.* 5. *May*, 1941. *p.* 295
Piping design and layout for diesel engine cooling systems; cooling towers; requirements and how they are affected by operation; the two circuit system; why piping is important; advantages of sizing pipe to decrease pipe friction; other piping details; facilities for cleaning the piping; pump characteristic and system characteristic curves.

Properties of Plastic Piping, by William H. Adams, Jr.
Vol. 13, *No.* 9. *September*, 1941. *p.* 571
Brief review of design and installation of molded phenolic resin piping; chemical resistance; friction loss; pressure requirements; installation and support; expansion and contraction; maintenance.

Protecting Piping and Tanks from Cold Weather Damage, by Siegfried Ruppright
Vol. 13, *No.* 11. *November*, 1941. *p.* 697
Troubles caused by freezing; anti-frost measures; replacing heat loss by electrical means; illustration showing acid container at chemical plant wired for electric heating; practical wattages for pipe lines.

Relief Program for Hot Water Tanks, by F. M. Dawson and A. A. Kalinske
Vol. 13, *No.* 5. *May*, 1941. *p.* 281
Hazards in heating water; how "explosions" occur; recommendations for installation of pressure and temperature relief valves on hot water storage tanks; formulas for discharging capacity of valves; various types of pressure and temperature relief devices.

Reports Progress in Revising the Code for Pressure Piping
Vol. 13, *No.* 1. *January*, 1941. *p.* 22
Statement by E. B. Ricketts, chairman of sectional committee on code for pressure piping, on the new edition of the code; range of power section extended; conflict between piping code and ASME boiler code; gas and air sections, refrigeration section, and welding section revised; code to be ready for distribution later this year.

Seeks Standardization of Valves on Nitrogen Bottles
Vol. 13, *No.* 9. *September*, 1941. *p.* 563
Campaign launched for mandatory standardization of valves used on industrial nitrogen bottles; accidents caused when oxygen is used by mistake instead of nitrogen; danger of explosion through contact of oxygen and oil.

Sizing Vent Piping for Safety Valves, by Max W. Benjamin
Vol. 13, *No.* 10. *October*, 1941. *p.* 615
Rules-of-thumb often satisfactory, but more rational basis sometimes needed; method for calculating size of safety valve vent piping which has been used with success; the design requirements; acoustic velocity; umbrella fitted vent pipes; factors to be considered in calculating pipe size; the problem and its solution; typical example; approximate values of acoustic velocity for steam; assumed overall nozzle efficiency.

Socket Welding Fittings Standardized, by Sabin Crocker and G. A. Daeuble, Jr.
Vol. 13, *No.* 8. *August*, 1941. *p.* 473
Discussion of background and highlights of proposed American Standard for Socket Welding Fittings; development of welding piping systems; need for standardization; deep *vs.* shallow sockets; committee organization; strength of fillet welds; basic dimension—center to bottom of socket; service ratings; material specifications; hydrostatic testing; standard fitting types; other items within scope of standard; acceptance by industry; tables and drawings showing dimensions of socket welding elbows, tees, crosses, 45 deg elbows, couplings, half couplings; dimensions of welded and seamless steel pipe.

Soil Sterilizing for Small Greenhouses, by L. S. O'Bannon
Vol. 13, *No.* 6. *June*, 1941. *p.* 361
Heating soil with steam is economical means of destroying pests which sometimes infest plant beds of greenhouses; plan of soil sterilizer; description of system which was designed for small greenhouse; size of nozzles; performance test; soil temperatures; steam pressures; steam consumption; references to bulletins treating subject of soil sterilization.

Specification for Welding Fittings, by J. H. Romann
Vol. 13, *No.* 5. *May*, 1941. *p.* 302
("Open for Discussion"); comment on articles by J. J. Kanter in April and May issues of HPAC.

Steels for Welding Fittings, by J. J. Kanter
Vol. 13, *No.* 4. *April*, 1941. *p.* 213
Discussion of new ASTM tentative specification, A234-40T, on factory made wrought carbon steel and carbon molybdenum steel welding fittings; reason for developing the materials specification; manufacturing processes used; committee organization; scope of the specification; chemical requirements; heat treatment and physical tests; highly alloyed steels; wide range of manufacturing operations recognized. (Discussion on p. 302, May.)

Steels for Welding Fittings, by J. J. Kanter
Vol. 13, *No.* 5. *May*, 1941. *p.* 288
Requirements of the new ASTM tentative specification for welding fittings, A234-40T; carbon molybdenum steel fittings; welding operations; testing and certifying; marking fittings.

Surface Defects in Heavy Wall Pipe, by Sabin Crocker
Vol. 13, *No.* 1. *January*, 1941. *p.* 12
Difficulties encountered in obtaining carbon-molybdenum steel pipe with satisfactory surface finish have led to incorporating new requirements in ASTM specifications; types of surface defects encountered described and illustrated; troubles with no definite standards for guidance of inspectors; definition of surface defects; the new requirements; opinions for and against the new requirements.

Testing and Drying Refrigeration Systems, by H. R. Jaeggli
Vol. 13, *No.* 8. *August*, 1941. *p.* 497
("Open for Discussion"); comment on article by Melvin A. Ramsey on testing and drying refrigeration systems, published in June, 1941, HPAC; soap and water for testing effective only for large leaks; advantages of testing with torch; cooling exhaust air from air compressor; valves for sectionalizing system; use of an air-"Freon" mixture for testing; trouble can be caused by a very small amount of moisture.

Testing and Drying Refrigeration Systems, by Melvin A. Ramsey
Vol. 13, *No.* 6. *June*, 1941. *p.* 347
Novel method of testing refrigeration and air conditioning systems for tightness using air pressure; developed for testing two 270 ton installations and now applied as routine procedure; test pressure maintained several days; pumping air into system; method of drying system; advantages of method; measuring pressures; mercury absolute pressure gage. (Discussion on p. 497, August.)

Time Study of Pipe Fitting Leads to Incentive Plan
Vol. 13, *No.* 12. *December*, 1941. *p.* 755
Measurement system devised at East Pittsburgh works of Westinghouse Electric and Mfg. Co. for controlling pipe fitting costs; time studies made; decrease in supervision cost; men have been able to increase their earnings.

Unused Ice Plant Capacity Serves Albeth Skating Rink, by F. S. Clark
Vol. 13, *No.* 7. *July*, 1941. *p.* 412
Description of outdoor skating rink built by Albeth Ice Co., Allentown, Pa., to make use of extra ice plant capacity during fall, winter and spring; piping layout; 10 miles of steel piping; special commercial brine resistant sealing compound used for making up joints; nipples gas welded to header pipes; valves for regulating flow of brine; piping arranged for self-venting of air.

Welding Plays a Vital Rôle in Production for Defense, by J. H. Romann
Vol. 13, *No.* 6. *June*, 1941. *p.* 366
Shell manufacture during first world war; hydraulic press equipment; piping connections; difficulties in maintaining tight joints; need for Sunday maintenance work; fortunate today in having advanced in art of welding, as safety factor has reached 100 per cent; this factor, together with savings in installation and maintenance, has made welding industry of national importance; advantages of welding piping on ships.

Why a Pounding Noise in Hot Water Supply System?, by F. M. Dawson
Vol. 13, *No.* 4. *April*, 1941. *p.* 225
Answer to a reader's question on cause of pounding noise in a vertical range boiler when water is being heated; probable causes of noise other than water pounding; over-heating of water; poor circulation due to lime in pipes or coils; importance of proper piping connections to prevent collection of air.

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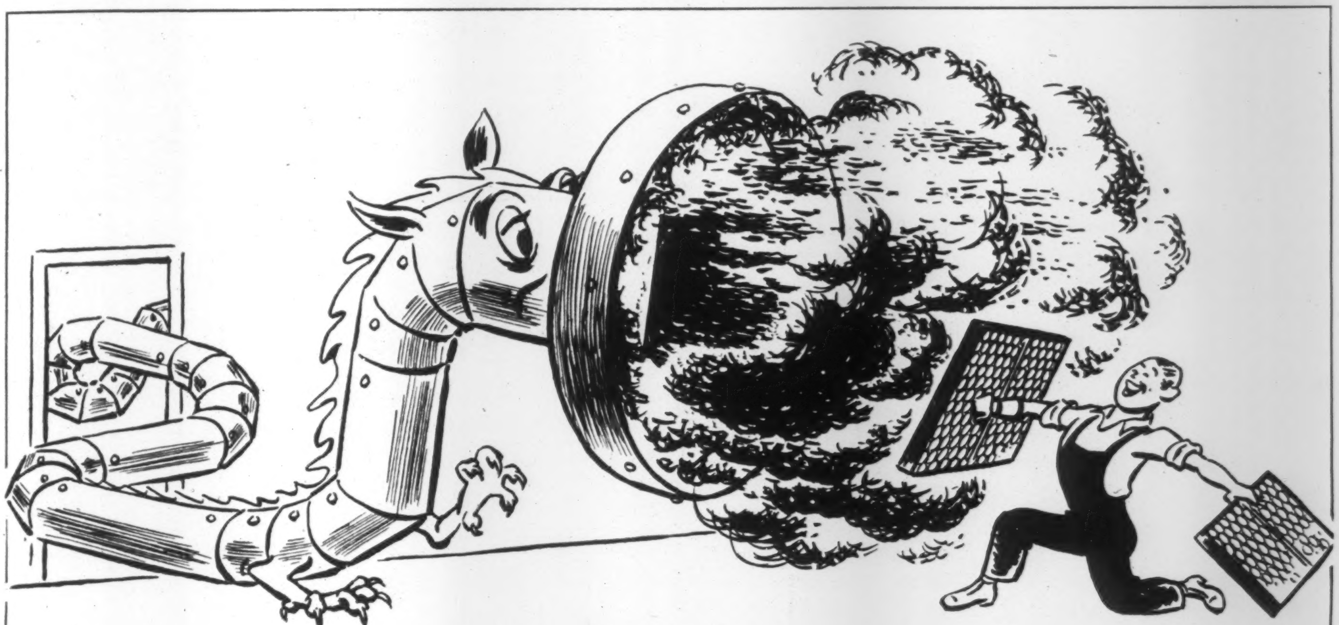

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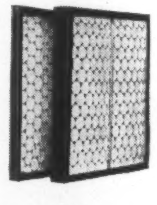

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No. 2020—The 76 yr old A. M. Byers Co., long a leader in the manufacture of wrought iron, has announced that it soon will enlarge its activities to include the production of alloy steels, including stainless.

Production will begin within four to six months. An addition will be built to the company's Ambridge plant, and will be used as a melt shop for new electric furnace equipment that is to be installed. Other basic production equipment for heating and rolling alloys already is in existence within the plant, L. F. Rains, president, states.

Initial products will be billets and bars for alloy steel fabricators.

"We have been contemplating, for some time, the advisability of entering into the manufacture of alloy steels, for which there has been a constantly growing market that does not conflict with our wrought iron business," said Mr. Rains.

"Promotion of wrought iron in present markets and the development of new uses is being carried on in an extremely aggressive and organized manner, so that we may be sure of our full share of business from this quarter, and in direct ratio to a rising tide of demand. Both from the standpoint of manufacturing, as well as sales experience, our organization is well qualified to develop along specialty lines. We feel that we have reached a point in our corporate existence where the alloy steel business opens up new opportunities."—A. M. Byers Co., Clark Bldg., Pittsburgh, Pa.

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No. 2021—The averaging thermostat zone control system is a new modulating system of control for two pipe steam heating plants where a constant source of steam is available. Suitable for single or multiple zone application, it employs two or more graduate acting thermostats which are placed at representative locations in the zone and which position a modulating zone valve in accordance with their average demand.

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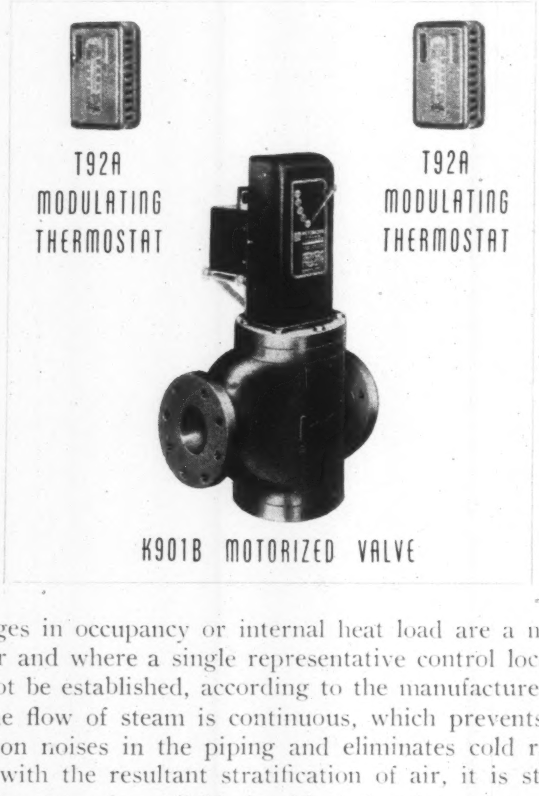

The flow of steam is continuous, which prevents expansion noises in the piping and eliminates cold radiators with the resultant stratification of air, it is stated.

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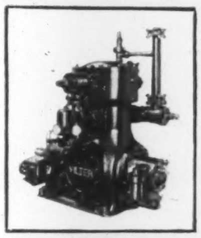

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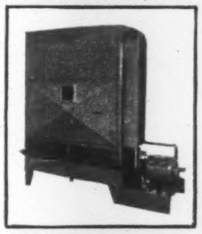
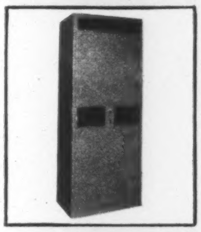


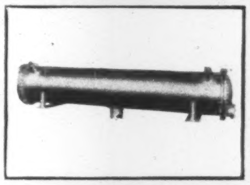
Offer complete Air Conditioning, humidity control cooling, and air circulation in a single unit, at low cost. Available in Dry Coil or Spray types.

Vilter Self-Contained Air Conditioning Units



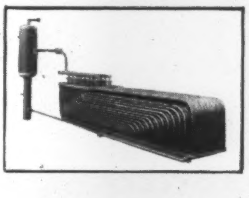
For comfort cooling in Stores, Offices and Shops. Made in capacities of 3 and 5 tons.

Vilter Shell and Tube Condensers



Condensers in all sizes and styles from one ton horizontal continuous pass, up to the largest vertical.

Vilter Brine Tank Coils



Provide maximum refrigeration capacity with minimum space requirements.

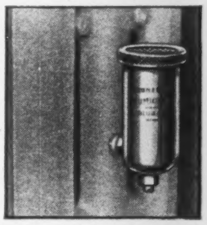
also . . .

a complete line of Water and Brine Coolers, controls and accessories.

Superior Since 1867
VILTER
Air Conditioning
Refrigeration . . .
MILWAUKEE

REFRIGERATION
TODAY'S HIGH STANDARD in *Performance!*

MAID-O-MIST
LEADERS in Automatic Humidifiers!



THE NO. 95 AUTO-VENT AUTOMATIC HUMIDIFIER
FOR LOW PRESSURE STEAM RADIATORS

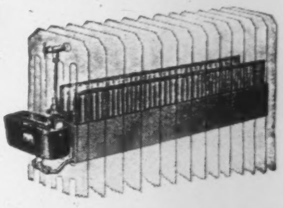
This unique nationally advertised humidifier is in use in thousands of homes, factories and offices throughout the land. Simple in design but most efficient in operation it discharges one pint of water vapor per hour at one pound pressure in the radiator. It can be installed on any radiator within a few minutes by merely removing the air valve and screwing an Auto-Vent into its place. It automatically humidifies every minute there is steam in the radiator thereafter. Auto-Vent is built completely of non-ferrous metals to avoid corrosion. A slotted adjustment post controls amount of humidity. Auto-Vent also acts as a highly efficient air vent valve.

No. V-95 Auto-Vent Automatic Humidifiers

Designed especially for vacuum steam systems. It is equipped with a bellows and ball check in the top of the valve seat which prevents air from re-entering the radiator during the time that a vacuum is being maintained in the heating plant.

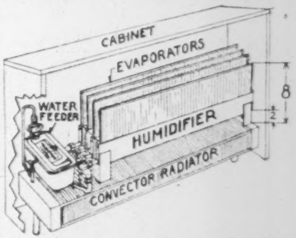
Ol' Faithful
AUTOMATIC HUMIDIFIERS

For Hot Water and Steam Radiators



Maid-O'-Mist Ol' Faithful Automatic Humidifiers are priced within the reach of all. Ol' Faithful is most efficient in operation, on either hot water or steam radiators. When installed on hot water radiators the water supply may be taken direct from the radiator or nearest water line. The Patented Copper bound evaporators last indefinitely and evaporate as much as 1½ gallons of water daily with a temperature of 130° at the radiator. Maid-O'-Mist Ol' Faithful Automatic Humidifiers come in three sizes. The No. 30 is supplied either 18" or 24" long, and the No. 34 is 34" long. Here is some easy money for every dealer.

CONVECTOR AUTOMATIC HUMIDIFIERS

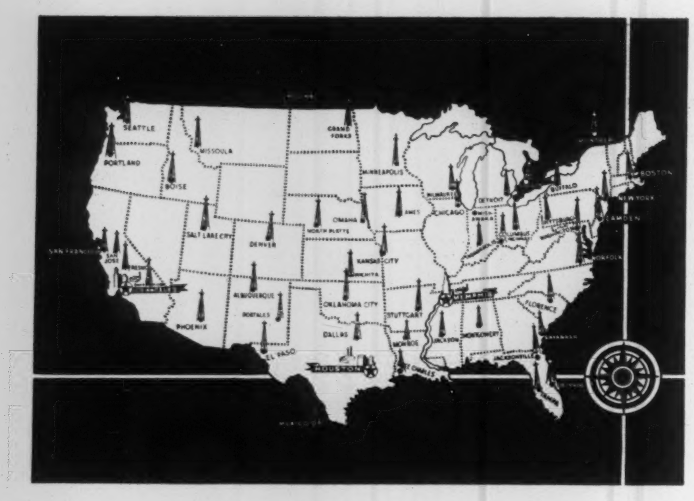


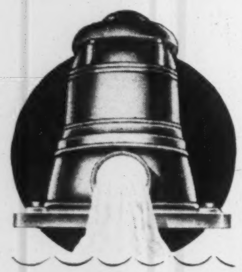
Designed especially for Hot Water, Steam, or Vapor Concealed Convector Radiators. For concealed radiators there is no better humidifier than the Maid-O'-Mist Convector Automatic Humidifier. Designed especially for this purpose it is naturally most efficient in operation. The automatic water feeder controls water level in the troughs . . . the patented metal edge evaporators last indefinitely and assure maximum evaporation . . . corrosion is avoided by the use of non-ferrous metals throughout . . . and its operation is safeguarded from pipe scale, dirt, etc., by a Monel metal filter screen. The Maid-O'-Mist Convector Automatic Humidifier comes completely assembled for installation in two and four troughs, sizes ranging from 22" to 39" in length over all.

Maid-O'-Mist Manufactures a Complete Line of Automatic Humidifiers for Steam, Hot Water, Vapor and Warm Air Heating Systems.

MAID-O'-MIST INC.
AUTOMATIC HUMIDIFIERS
FOR ALL TYPES OF HEATING SYSTEMS

211 NORTH ABERDEEN STREET
CHICAGO ILLINOIS





First

IN NATION-WIDE SERVICE

Layne service extends to the four quarters of the globe, but here in the United States it has reached its greatest efficiency. Dotted on the map from coast to coast and from border to border are Layne men and equipment ready to solve your water supply needs.

Expansion is the order of the day. Production must not lag. Never has the need for an adequate supply of water been more vital. Old wells may be reconditioned to step up their output. It might be necessary and more economical to install a completely new well water system. In either case, Layne engineers are ready to cooperate. Their experience is valuable. They will study your needs and make dependable recommendations. They will tell you facts about Layne Wells and Pumps—facts that are proven in world-wide service.

Write if you want a Layne representative to call. A complete file of catalogs, bulletins and folders may be had without obligation. Address

LAYNE & BOWLER, INC.
Dept. D, Memphis, Tenn.

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LAYNE-ARKANSAS CO. STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA.
LAYNE-CENTRAL CO. . . MEMPHIS, TENN.
LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA.
LAYNE-NEW YORK CO. . NEW YORK CITY AND PITTSBURGH . . . . . . PA.
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LAYNE-OHIO CO. . . . COLUMBUS, OHIO
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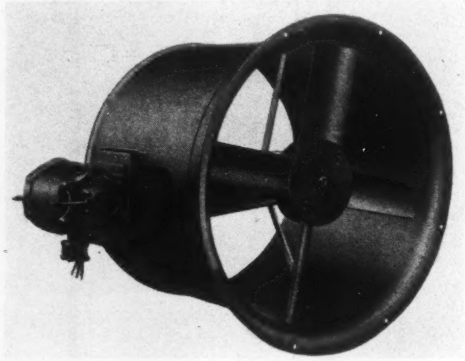
LAYNE-WESTERN CO. OF MINNESOTA MINNEAPOLIS . . . . . . MINN.
LAYNE-BOWLER NEW ENGLAND COMPANY BOSTON . . . . . . MASSACHUSETTS
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . . . ONTARIO, CANADA

LAYNE

PUMPS & WELL WATER SYSTEMS

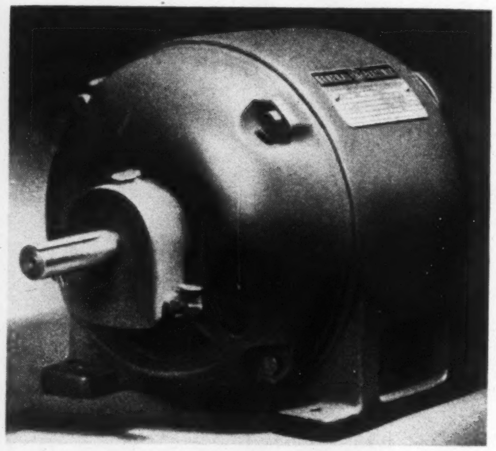
For Municipalities, Industries, Railroads, Mines and Irrigation



Fan wheels are of die formed aluminum, and blades are removable for cleaning. Standard sizes are 18 to 42 in.—DeBothezat Ventilating Equipment Div., American Machine and Metals, Inc., East Moline, Ill.

Polyphase Motors

No. 2023—As a result of a survey of changing requirements of industrial customers, an entire line of new polyphase induction motors, in integral horsepower sizes, to conform with new industrial trends, processes, and practices, has been announced. Known as the "Tri-Clad" motor and representing one of the most extensive product changes in the history of its manufacture, it has called for new methods in manufacturing.



In all its ratings it features modern streamlined appearance; complete protection through the use of a cast iron frame; advances in the insulation of current carrying parts; and improved bearing design and lubricating arrangements, the manufacturer states. It incorporates a cast aluminum rotor, pressure relief system of greasing for ball bearing motors, and other proven features.

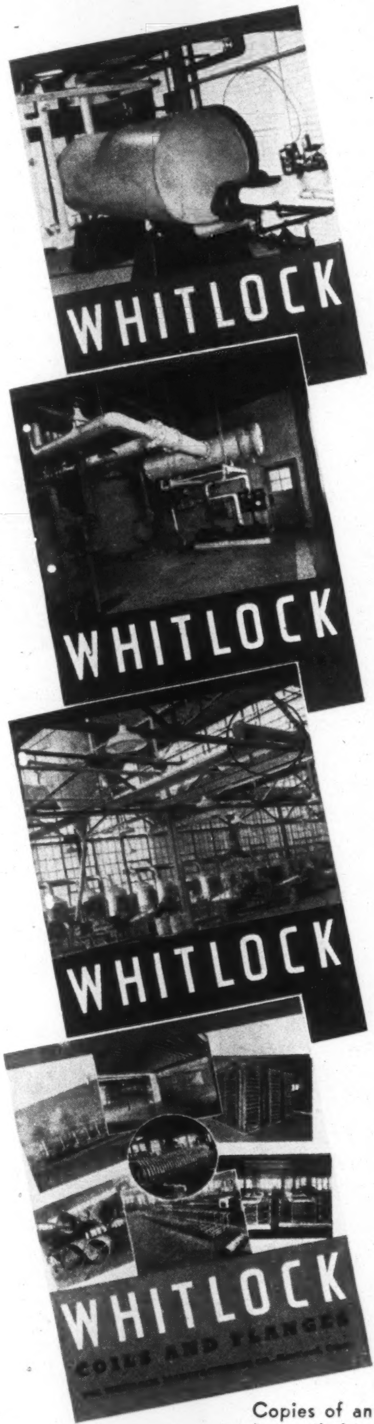
In place of the conventional open frame, it makes use of a cast iron frame of the box type. The end shields are designed to match the frame and are enclosed above the center line. This combination of frame and end shields minimizes contact of vital motor parts with foreign material such as lubricants, coolants, and other liquids, as well as chips, tacks, etc., while also protecting it against accidental blows in handling or similar rough usage, it is said. The new type insulation, dust tight bearings, and the use of "Glyptal" in the priming and finishing paints armor it against the attack of harmful agents.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Trap Replacement Unit

No. 2024—The results of an unusual life-test on the diaphragm member used in a line of thermostatic traps and replacement units were recently released. In this test, a standard diaphragm was alternately subjected to

WHITLOCK

Bulletins you should have—



Storage Heaters
Bulletin 40
16-page Bulletin filled with valuable engineering tables: how to select proper size heater; ASME code thicknesses for steel and Everdur shells; specifications; typical installation diagrams, etc.

Instantaneous Heaters
Bulletin 20
Illustrates and describes U-tube, straight-tube, and coil-tube heaters; gives typical installation layouts; shows use with storage tank; swimming pool; and as convertors and economizers.

Quenching Oil Coolers
Bulletin 101
Keeping quenching oil uniformly at the correct temperature is vitally important in heat treatment of steel. Bulletin shows coolers designed for this service and correct installation.

Coils, Flanges, Headers
Bulletin 92
Coils for refrigerating and heating; welded-on flanges; welded tanks and headers; tables of pipe and flange dimensions; typical coil forms; illustrations of coil making.

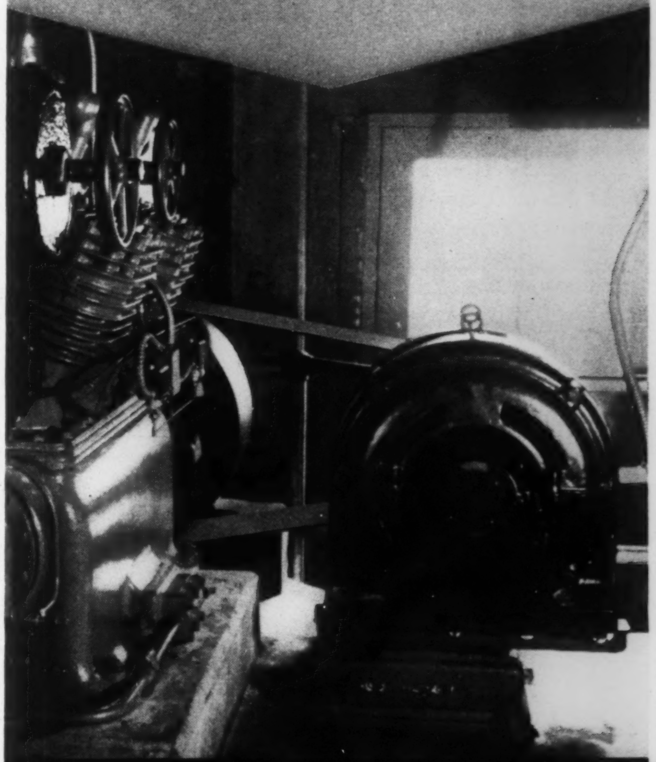
Copies of any or all of these Bulletins will be mailed upon request. Address—

THE WHITLOCK MANUFACTURING CO.
44 South St., Elmwood, Hartford, Conn.
District offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond.

LIFE INSURANCE COMPANY TAKES OUT HEALTH ASSURANCE *with* AIR CONDITIONING UNIT

Between 100 H.P. motor and Carrier compressor, power flows smoothly in a Life Insurance Company's office building . . . transmitted efficiently by a 13" heavy double TANNATE belt. Correct belt tension is automatically maintained at all times by the No. 12 Rockwood base. This belt and base form a perfect power-thrifty unit for short center drives.

Suggestion: If you have a problem involving a short center drive, see what TANNATE-ROCKWOOD has done in similar applications. Pertinent data is yours on request; just write us on your letterhead.



STEP UP PRODUCTION WITH

RHOADS

Founded 1702

Tannate-Rockwood

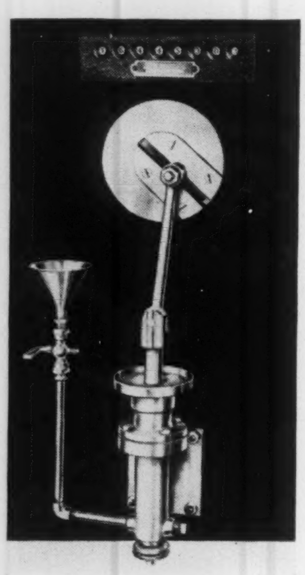
the ideal

SHORT CENTER DRIVE

J. E. RHOADS & SONS • 35 N. SIXTH ST., PHILA., PA.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

2½ lb pressure and 5 in. of vacuum, expanding and contracting through a distance of ⅛ in. in each movement. Moving through this cycle 95 times a minute, the diaphragm has withstood well over 16,000,000 expansions and contractions to date, and still shows no signs of failure, the maker states.

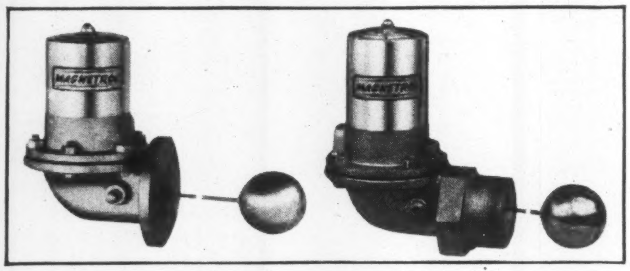
The testing device, shown here, is a simple hydraulic pump with provision at the bottom for the diaphragm to be attached.—Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston, Mass.



Liquid Level Controls

No. 2025—New additions to the line of "Magnetrol" liquid level controls include controls for tank or vat application where it is necessary to maintain a liquid level within a certain differential. As an electrical unit they may be used to energize a pump, solenoid valve or motorized valve, including applications where explosion-proof equipment is necessary. Also, they may be used in an alarm system to flash or ring a bell when liquid level reaches a certain point. They are available for flange or screw-in mounting. Switching action is produced by magnetic attraction.

There has also been a new addition to this manufacturer's line of low water cutoff and boiler water level controls. It is a "package set" which provides all in one the necessary equipment for complete automatic control of boiler water level on low pressure heating boilers, including automatic feed and low water cutoff.—Fred H. Schaub Engineering Co., 325 W. Huron St., Chicago, Ill.



Heating System Control

No. 2026—The remote bulb "Econostat" is a new instrument to regulate heating systems in apartment buildings, office buildings, hotels, factories, etc. It is intended for those installations which cannot be satisfactorily controlled from a single thermostat, says the maker.

It regulates the heating directly from the outdoor temperature by supplying the heat at intervals. It maintains the desired indoor temperature by varying the "heat on" periods in accordance with outdoor temperature changes. Thus, the heat supplied to the building is in proportion to the heat loss from the building and is

HESS EQUIPMENT Approved For National Defense and Industry

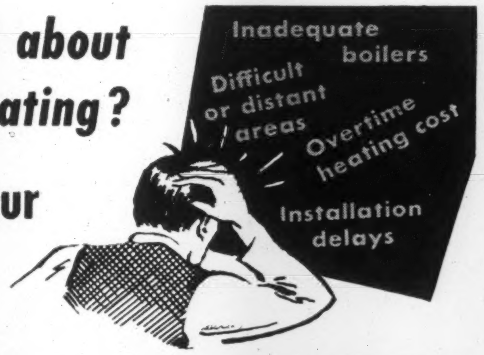
- Hess Pneumatic Condensers
- Hess Pneumatic Coolers
- Hess Pneumatic Driers
- Hess Pneumatic Heaters

For all classes of application requiring heating, cooling, drying and condensing utilizing air

67 YEARS OF EXPERIENCE

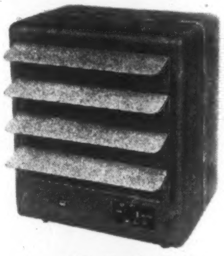
HESS WARMING AND VENTILATING CO.
Established 1873
1211-27 S. WESTERN AVE.
CHICAGO, ILL.

Worried about plant heating?



Forget your troubles with

CHROMALOX
ELECTRIC AIR HEATERS



Type HF for individual rooms. New streamlined design, attractively enameled. Fan can be used without heater, for hot weather cooling. Four sizes—1½ to 4 Kw.

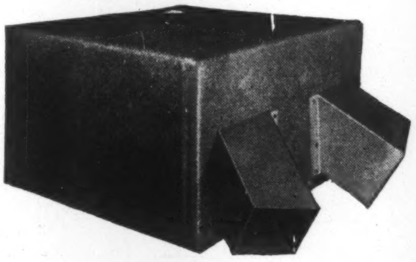
Type UB for offices and smaller areas. Attractive crackle finish. Adjustable louvers to direct blower-driven air. Heating unit can be disconnected for summer cooling. Eight sizes to 15 Kw.

LEAVE your overworked boilers alone, and heat the new plant extension electrically. Check on the low cost now with your power company or our experts. You may be surprised.

Heat "hard-to-reach" places electrically. No spot is hard to reach for a wire line. No heat loss or condensation problems involved—no piping leaks or bulky insulation.

Install your heat quickly, too. You know how quick it is to string a length of BX cable and connect it. Chromalox heaters are available now.

Add heat to that cold office or shop floor this easy way. And enjoy instant heat at any time — day, night, Sundays, holidays—without overtime heating cost. Chromalox heat is modern, economical, trouble-saving. Check on it.



How to select and apply electric units for heating liquids, machine parts, process, air blast, or any other industrial need, interestingly covered in the Chromalox Book of Electric Heat, mailed you upon request.

Type CUB electric unit heater for large areas. Centrifugal blower operated. Thermostatic control. 15 to 40 Kw.

EDWIN L. WIEGAND CO.
7610 Thomas Blvd.
Pittsburgh, Pa.

CHROMALOX
Electric Heat for Industry

INDEPENDENT
"Fabrikated" REG. U.S. PAT. OFF.
Adjustable
DIRECTED AIR FLOW REGISTERS and GRILLES

LEAD in Adjustability

An unlimited range of deflections is made possible by the ability to adjust the grille bars INDIVIDUALLY. Air flows can be directed up or down, or right or left. The directional adjustment can be made at the time of installing; and after the system is operating, corrections can be made at any time to meet unforeseen or changed conditions.

TWO NEW CATALOGS READY FOR YOU

Independent's two new catalogs just off the press are most complete, with interesting data on registers and grilles for air conditioning installations, and registers and cold air faces for gravity installations. Most conveniently arranged, everything easy to find. Send for your free copies.

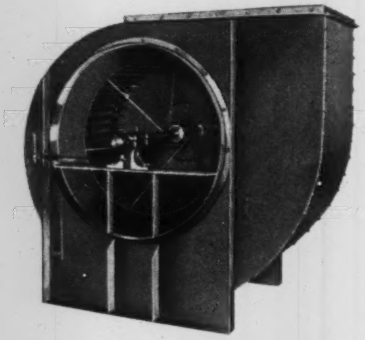
THE INDEPENDENT REGISTER CO.
3747 E. 93rd ST., CLEVELAND, OHIO

A41

EVERY Grille Bar Can Be INDIVIDUALLY Adjusted

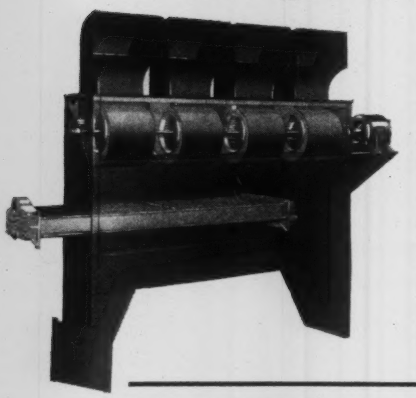
B&B MANUFACTURERS of HEATING and VENTILATING EQUIPMENT SINCE 1879

VENTILATING FANS



Whatever your ventilating problem, you will find a practical economical solution in selecting a Bishop and Babcock product. With the Squirrel Cage Type Fan made in all standard sizes from 6" diameter wheels to as large as 96", delivering from 250 to 500,000 C.F.M., combined with the Streamline Fan in standard wheel diameters from 18" to 75", you can specify a Bishop and Babcock unit for any ventilating requirement.

UNIT HEATERS



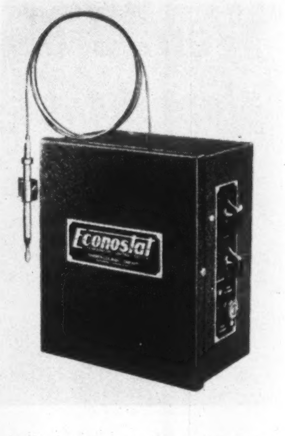
There is a size and model Bishop and Babcock Steam or Hot Water Unit Heater to meet your every requirement. Propeller Type and Blower Type for both ceiling and floor mountings in a complete range of sizes. Full information is available, write for bulletins.

SQUIRREL CAGE AND STREAMLINE FANS
MULTI-SERVICE BLOWERS AND EXHAUSTERS
PROPELLER FANS—UNIT HEATERS—FURNACE BLOWERS
AIR CONDITIONING FANS
AIR WASHERS—HEATING SPECIALTIES

TERRITORIES AVAILABLE FOR REPRESENTATIVES

The BISHOP & BABCOCK MFG. CO.
CLEVELAND, OHIO.
REPRESENTATIVES IN PRINCIPAL CITIES

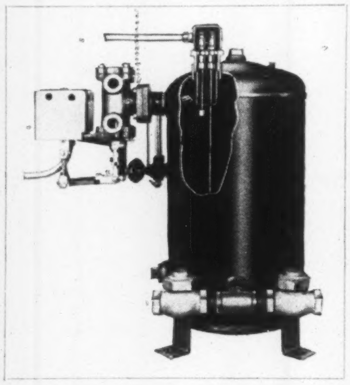
not dependent upon the temperature in any particular room. According to the manufacturer, this provides better temperature control with reduced fuel costs because it is completely automatic, supplies heat only when needed, and controls throughout the entire heating season.



It is readily installed in either new or existing buildings, and will control any type of heating system whether it be fired by a gas or oil burner, stoker or central station steam.—Barber-Colman Co., 225 Loomis St., Rockford, Ill.

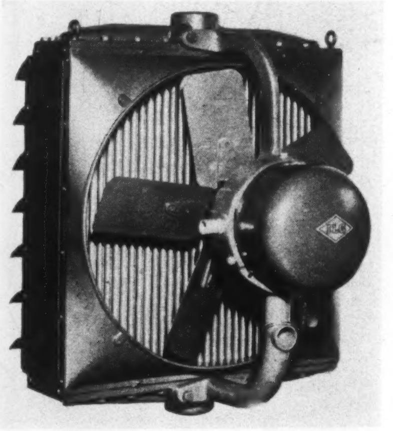
Lifting Trap

No. 2027—An answer to the problem of how to service or inspect return traps installed in hard-to-get-at places is found in the newly redesigned "Electrap," an electrically controlled boiler return or lifting trap, according to its maker. All the controlling valve gear has been gathered into one compact assembly. If the trap receiver must be installed in some inaccessible spot this solenoid operated steam inlet-vent valve can be brought out to any convenient location. The receiver then is completely without stuffing boxes, floats, or moving parts of any kind. Or the control may be right on the receiver. The motionless electrode control used is the same as has been used for several years on the company's boilerfeed pumps and water level controls.



This unit may be used for returning condensate to boilers, lifting or pumping water or other liquids, or draining systems under vacuum. It is available in sizes suitable for boilers from 20 to 200 hp, withstands pressures up to 150 lb and discharges as much as 21,000 lb per hr of water, according to the manufacturer.—Johnson Corp. 830 Wood St., Three Rivers, Mich.

Textile Type Unit Heater



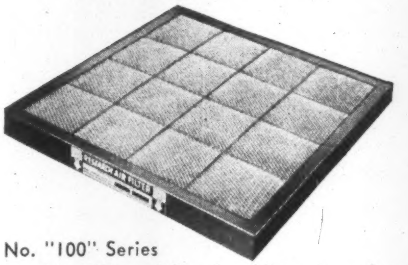
No. 2028—A new textile type unit heater for use where lint and other substances might adhere to fin surfaces and clog up the coils has been tested in several Georgia mills. As one mill official explained,

These units had to

There's A RESEARCH AIR FILTER

for every forced air and air conditioning need

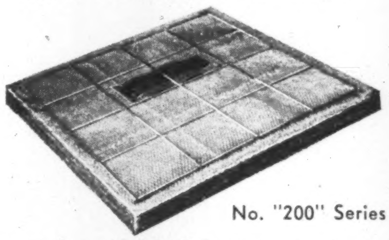
RESEARCH FILTER WITH CARDBOARD FRAME



No. "100" Series

Disposable filter, which when dirty, is replaced by entire new unit. For warm air furnaces, air conditioning units, filter banks.

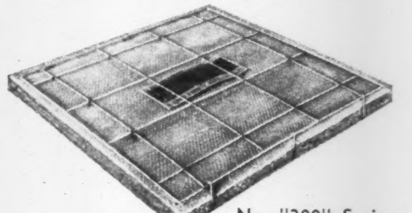
RESEARCH RE-FIL-ABLE FILTER WITH HOOKED WIRE GRIDS



No. "200" Series

Filter pad, sandwiched between 2 wire grids which hook together, is easily replaced. Used in furnaces, air conditioning units and filter banks.

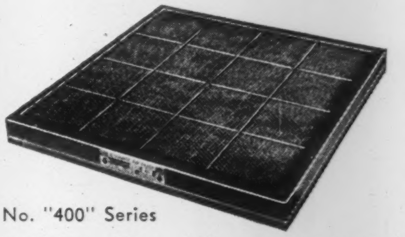
RESEARCH RE-FIL-ABLE FILTER WITH HINGED WIRE GRIDS



No. "300" Series

Easiest to change of all Re-Fil-Able filters. Replaceable pad held snugly between hinged wire grids. Used extensively in filter banks.

RESEARCH STEEL FRAME RE-FIL-ABLE FILTERS



No. "400" Series

Re-Fil-Able filter with permanent steel frame, complete with wire grids to hold the removable pad in rigid position. New pad easily inserted.

RESEARCH PRODUCTS CORP. RP MADISON, WIS.

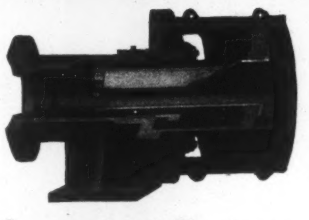
We shall be glad to place you on our mailing list for free technical data sheets. Write for our new bulletin on filter banks, also price sheets.

RESEARCH PRODUCTS CORPORATION

Madison, Wisconsin

ADSCO INTERNALLY-EXTERNALLY GUIDED JOINT

MOST COMPLETELY GUIDED, DEPENDABLE SLIP TYPE JOINT



Important Features

- Internal Guide on Slip
- External Guide in Hood
- No metal to metal contact between slip and body
- Semi-steel or Steel Body
- Bronze or Chromium plated steel slip
- Properly proportioned stuffing box
- Available in various sizes for high pressures and temperatures
- Lubrication Fittings

APPROVED by the ARMY and NAVY for NATIONAL DEFENSE PROJECTS

The ADSCO Internally-Externally Guided Expansion Joint meets the specifications of the Army Quartermaster Corps and the Navy Department Specification No. 66Pla. It has been approved for many years for installation on Army and Navy projects where the expansion and contraction of steam or hot water lines must be controlled with dependable equipment.

We are prepared to serve the national defense construction projects as they develop and the same dependable joints are available to private industry, colleges, institutions, public utility companies, etc., where they want time-tested steam distribution equipment that reflects over sixty years experience in its design and manufacture.

Write for Bulletin No. 35-20HP

Partial List of Users

U. S. Naval Air Station
Jacksonville, Fla.
U. S. Naval Air Bases
Alaska
U. S. Naval Base
Pearl Harbor, T. H.
U. S. Marine Hospital
Carville, La.
U. S. Army Barracks
Carlisle, Pa.
U. S. Army, McChord Field
Ft. Lewis, Wash.
U. S. Army, Chanute Field
Rantoul, Ill.
U. S. Army Ordnance School
Aberdeen, Md.
U. S. Army Base
Anchorage, Alaska
Norfolk Naval Hospital
Portsmouth, Va.
Naval Air Station
Lakehurst, N. J.
Fort McClellan
Anniston, Ala.
Army & Navy Hospital
Hot Springs, Ark.
U. S. Army Barracks
Plattsburg, N. Y.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

The Enduring Metal—

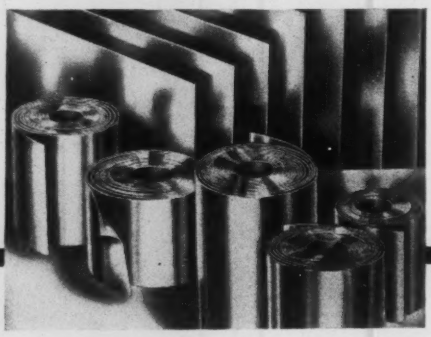
FOR ALL AIR CONDITIONING JOBS

HUSSEY

PURE LAKE COPPER

Thousands of years ago Indians found solid deposits of pure copper in the Great Lakes regions and beat it into many useful forms. Since unearthed, these ancient forms reveal the remarkable immunity of Nature's own copper to corrosion. Because Hussey Pure Lake Copper comes from the same pure Great Lake deposits, the working and corrosion-resisting qualities of Hussey are unique—one of the big reasons why Hussey Copper is so widely preferred in the air conditioning industry today. You will find it remarkably easy to work, shape and bend. Try Hussey on your next job.

C. G. HUSSEY & CO.
(DIVISION OF COPPER RANGE CO.)
Rolling Mills and General Offices: PITTSBURGH, PA.
Warehouses in Principal Cities



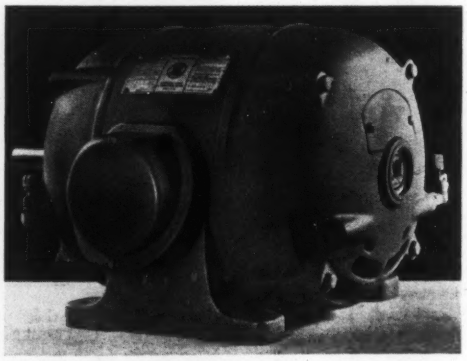
heat the knitting room in an atmosphere containing quantities of lint from the machines.

We are pleased to report that during the heating season of 1939-40, the severest winter Atlanta has had in 50 years, these units kept our knitting room at a temperature agreeable to the workmen and suitable for our machines.

In addition, they entirely overcame the problem of lint. The units were not "blown down" at all during the heating season, yet we found on shutting them down in the Spring that no lint had accumulated in them.

These units are available in three sizes.—Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Sleeve Bearing Induction Motor



No. 2029—New open type, sleeve bearing, squirrel cage induction motors ("Type CS") designed especially for general purpose drive applications such as pumps, machine tools, auxiliary drives, and others, are available in ratings from ½ to 5 hp, at speeds from 875 to 3600 rpm, for operation on 110, 220, 440, and 550 volts, 2 and 3 phase a-c.

More attractive and compact than before, the new motors are also strong mechanically, the maker states. Rigid, complete cast frames maintain constant air gap between stator and rotor to assure high efficiency. Frame improvements include new sealed sleeve bearings having a combination vestibule and felt washer seal, and a larger oil reservoir capacity. Oil filler cups may be inserted on either side of the motor.

Appearance has been improved. Elimination of sharp corners and projections gives a pleasing rounded contour. Castings are buffed to produce a smooth, even surface. Finish is a light machine tool gray.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Bronze Welding Rod and Flux

No. 2030—A new high test, flux coated bronze welding rod has eight advantages, the maker states: Low fuming. Applies faster. Denser deposit. Increased tensile strength. Greater bond strength. Increased hardness of deposit. Materially improved ductility. Time saving.

Time formerly lost in removing a bare rod from the molten puddle and dipping it into a flux can is time saved when these new rods are used, according to the manufacturer.—Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.

Humidifier for Vacuum Heating

No. 2031—A new humidifier for use with vacuum heating systems will discharge as much as 1 pint of water vapor per hr at 1 lb steam pressure, the manufacturer states. The amount of vapor discharged is controlled by an adjustment valve. It also acts as an air vent valve,

PLAY SAFE

Your Jobs Are Only As Good As Their Valves

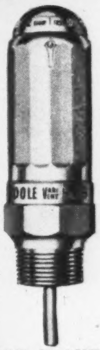
SLOW | FAST
DOLE VARI VENT No.1A

DOLE No. 1A VARI-VENT AIR VALVE

The No. 1A Vari-Vent is outstanding in an All-Star line, for balancing the flow of steam to radiators of oil, gas or stoker-fired systems at the first breath of boiler pressure. The new domed adjustment cap adds eye-appeal—improves venting.

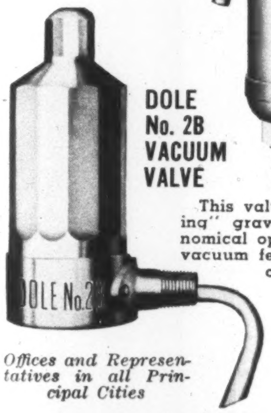
DOLE No. 1B VARI-VENT AIR VALVE

For balancing the flow of steam to convectors, either cast iron or copper, of oil, gas, or stoker fired systems. Extra large venting port permits efficient heating from low boiler pressures.



DOLE No. 1C QUICK VENT FLOAT VALVE

For venting steam mains and speeding up the flow of steam to radiators of automatically fired systems. Specially recommended for use in conjunction with Dole Vari-Vent Air Valves No. 1A or No. 1B.



DOLE No. 2B VACUUM VALVE

This valve is for venting radiators and "vacuumizing" gravity steam heating systems for most economical operation. It has the patented Dole bellows, vacuum feature that locks out air after it has been once expelled from the system.

AND 18 OTHERS FOR EVERY CURRENT TYPE OF AIR & VACUUM VALVE INSTALLATION

Write for 1940-41 Catalog

Offices and Representatives in all Principal Cities

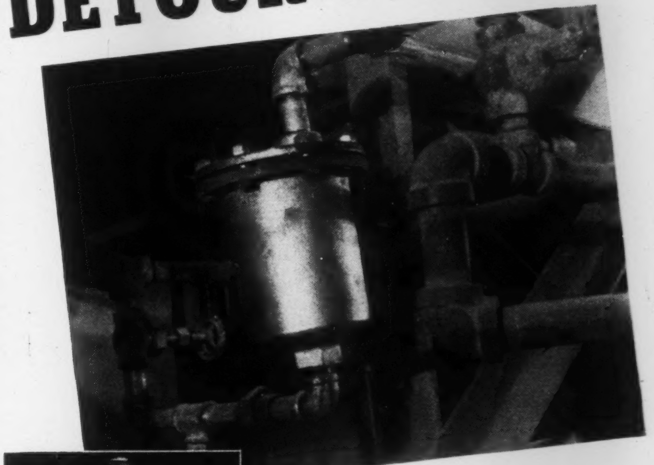
THE DOLE VALVE COMPANY
1901-41 Carroll Ave. Chicago, Ill.

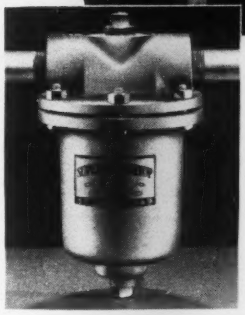
DOLE

Air and Vacuum VALVES

WHY

DO YOU PUT UP WITH DETOUR PIPING?





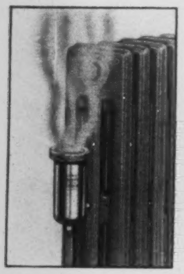
● Why do you continue to put up with complicated, "detour" piping when simplified piping costs no more, looks neater, saves installation time and gives long service life?

Anderson Super-Silvertop, the inverted bucket trap with simplified piping, is noted for neat, clean-cut installations—straight-in-line piping. It averages more condensate capacity because of larger bucket and longer lever arm. Super-Silvertops are backed by 55 years of steam trap manufacturing experience. Regular inspection is much faster because traps are inspected without disturbing pipe connections. Also, nationwide distribution and experienced field men are assurance of prompt attention and help on trapping problems.

Think about this engineered steam trap—then ask yourself—"Why do I put up with detour piping?" Then decide to do something about it. Send for your copy of "How To Choose A Steam Trap." It's a helpful book of charts, tables and useful information that you can use almost every day. Get your copy and find out more about Anderson Super-Silvertops and simplified piping. Write today.

THE V. D. ANDERSON CO.
1949 West 96th Street • Cleveland, Ohio

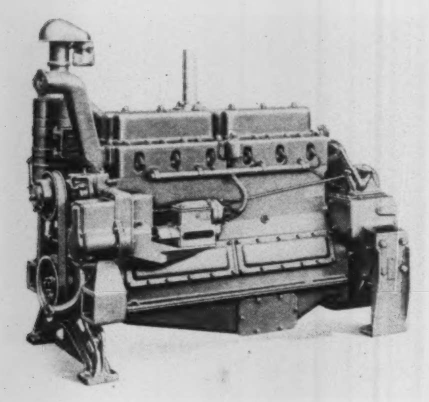
Super-Silvertop STEAM TRAPS



and is equipped with a bellows and a ball check in the top of the valve seat which prevents air from re-entering the radiator during the time that a vacuum is being maintained.

This humidifier is constructed of non-ferrous metals. — Maid-O'-Mist, Inc., 215 N. Aberdeen, Chicago, Ill.

Natural Gas Engines

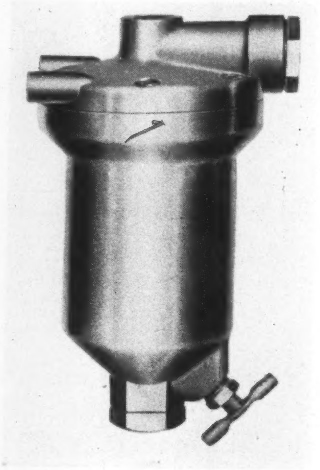


No. 2032—Three models of heavy duty natural gas engines have recently been announced. They are built in two cylinder sizes, a six and a four. Each has a bore of 4¾ in. and a 5½ in. stroke and they develop 74 and 48 hp respectively at 1600 maximum governed rpm. A small four, with a bore and stroke of 3¾ in. x 5 in., develops 34 hp at 1650 rpm.

A combination gas - gasoline carburetor is standard equipment, and though the engine will satisfactorily burn gasoline for short periods such as for starting purposes when gas is not available, the fuel system is set for the most efficient combustion of natural gas, the maker says.

The company also manufactures natural gas conversion attachments for its six and eight cylinder, 5¾ in. bore engines, rated at 140 and 190 maximum horsepower, respectively. To change from diesel to natural gas, the pistons do not have to be touched, nor do any changes have to be made to interior parts of the engines. The entire change-over takes about 4 hr, and can be done in the field.—Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.

Automatic Water Drain



No. 2033—A new automatic water drain is available with four convenient fitting assemblies, and is intended for installation in compressed air lines, on air compressing outfits, or air receivers. It is known as the "Type HOD," and according to the maker it automatically drains the air line or air receiver, preventing water from being carried into the tool being used. It thereby prevents rusting and corroding, and assures

DIRECTHERM (*Direct-Fired*) HEATERS ***for Oil, Gas or Coal***

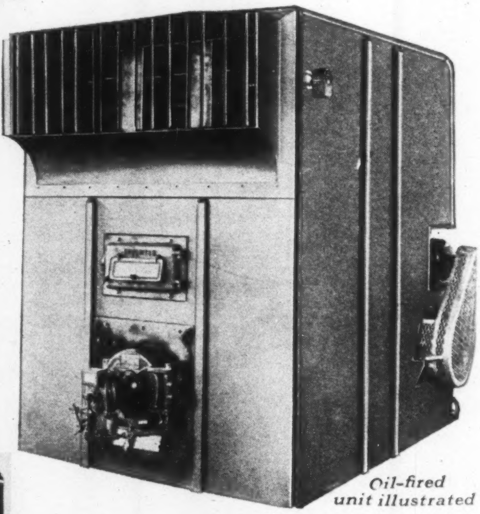
Low First Cost . . . Low Installation Cost . . . Low Heating Cost . . . Wide and Uniform Heat Distribution . . . High Heating Efficiency.

SIX STANDARD SIZES
300,000 to 1,700,000 Btu's

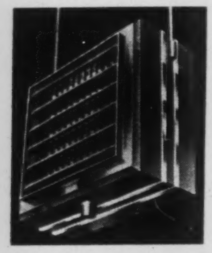
Directherm Direct Fired Unit Heaters are available in six standard sizes with capacities ranging from **300,000** to **1,700,000** Btu's. The units are made up of heavy steel plates, sheets and sections, with all welded joints throughout. Nothing to loosen and permit variation in quantity of combustion air. Readily cleanable flue gas header to maintain high combustion efficiency.

INVESTIGATE THE DIRECTHERM NOW . . . if you are building or contemplating building a new plant or additions to your present plant capacity. Get complete details by writing today.

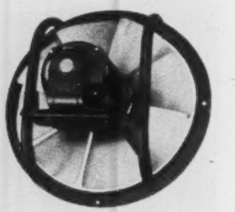
THE DIRECTHERM, direct fired heater, is solving the heating problems for expanding industry everywhere. Heating engineers and industrial architects recommend modern warm air industrial heating. The Directherm is the answer. Designed for direct discharge or with duct work. Ask for bulletin No. 305A.



Oil-fired unit illustrated

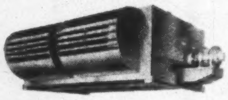


THE AIRVECTOR—propellor type fan—highly efficient unit heater for ceiling suspension or for mounting in recirculating stack. THE AIRHEATOR—heavy capacity centrifugal fan type unit for floor or ceiling mounting.



AIR-VENT Exhaust Fans—to meet industrial and general requirements for a rugged, heavy duty type fan of simplified construction.

THE AIRBLANKET (PROPELLOR FAN TYPE) . . . a new style of unit heater with a patented method of air direction control. Especially suited for high ceiling jobs. Provides absolute control of warm air.



THE AIRBLANKET (CENTRIFUGAL FAN TYPE) . . . involves the exclusive Airblanket principles, using a high velocity of cool air to roll the stream of warm air down to the floor.

Engineering offices in all principal cities. Write for descriptive literature.

AIRTHERM MANUFACTURING COMPANY • 712 S. SPRING • ST. LOUIS, MO.

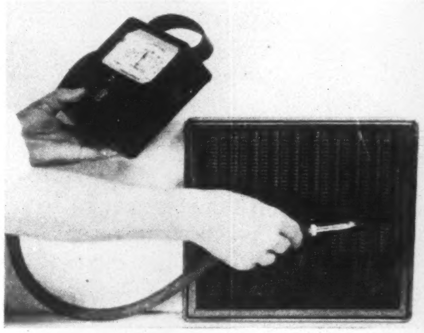
Quick, Positive Readings With the ALNOR VELOMETER

The Velometer is a versatile direct reading air velocity meter which gives instantaneous readings of the speed of air measured in feet per minute.

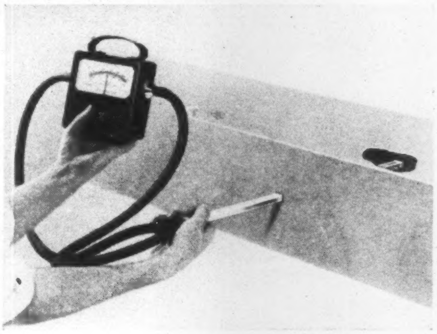
Anyone can use the Velometer. No mathematical calculations, no leveling—no timing.

As its movement is actuated by the pressure or impact of the air against a swinging vane, it is essentially a pressure instrument—thus it can be scaled to not only read velocities directly, but also to read static or total pressures when using suitable jets.

Made in standard ranges for velocity readings from 20 fpm to 6000 fpm and 3 in. static or total pressure. Special ranges available as low as 10 fpm and up to 24,000 fpm velocity and 20 in. pressure.



View shows the Velometer with the angle spot Jet Type 2220 in use for checking velocity conditions across face of a grille.



Showing use of Velometer with Duct Jet Type 2425 taking velocity readings in a duct.

"ALNOR" DISTANT READING ELECTRIC THERMOMETERS

The use of "Alnor" multi-point resistance type thermometers is rapidly increasing not only in air-conditioning, but also for heating and refrigerator installations.

The instrument can be located in the machinery room or boiler room with the elements located on various floors in any part of the building, or outdoors, thus providing the engineers with constant and convenient temperature readings.

"Alnor" thermometers are made in several styles and sizes, both portable and mounted types.

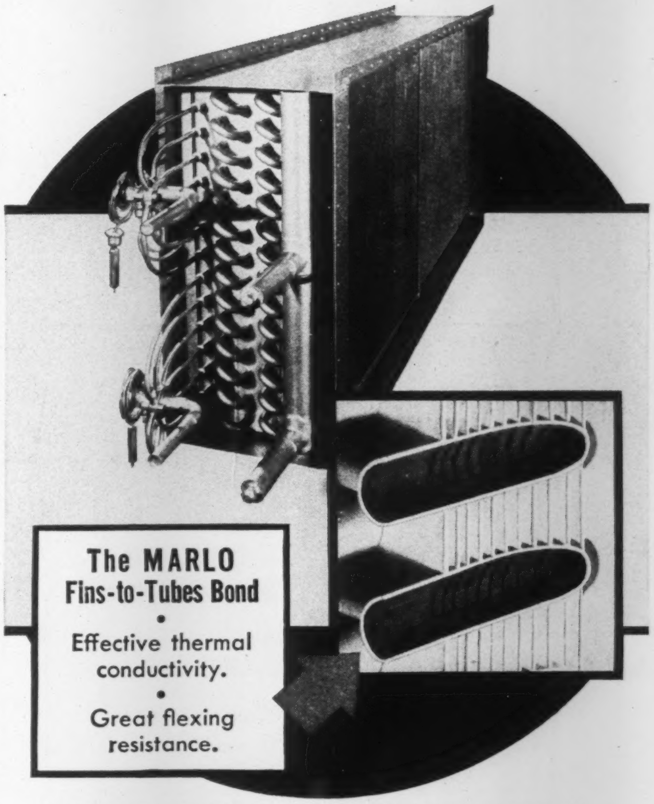
"Alnor" round type multi-point resistance thermometer with built-in switch.

Write for further information

Illinois Testing Laboratories Inc.

Don't Guess Know!

419 N. La Salle Street—Chicago, Illinois
Testing Engineers and Manufacturers



The MARLO Fins-to-Tubes Bond

•

Effective thermal conductivity.

•

Great flexing resistance.

★MORE EFFICIENT AIR CONDITIONING WITH MARLO COIL UNITS

for direct expansion air cooling, supplied complete with distributor and valve. Made of suitable material for ANY refrigerant. Absolutely pressure-tight.

Our Bulletin 406 describes our short method of selecting a coil. Send for it, free of charge.

We invite you to see our interesting exhibit, booth 154-5, at the All-Industry Refrigeration Show, Chicago.

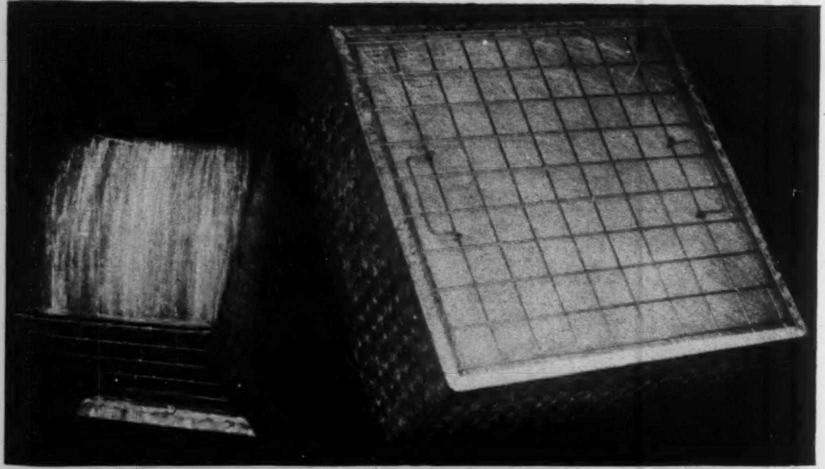
MARLO COIL COMPANY

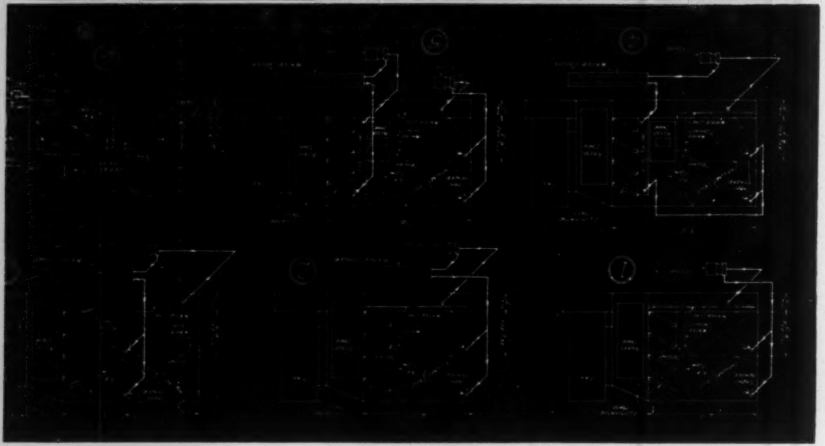
6135 Manchester Avenue St. Louis, Missouri

Manufacturers of heat-transfer surface for any application.

CAPILLARY
AIR CONDITIONERS

Every Air Conditioning Engineer and all Industrial Engineers responsible for air conditioning should be familiar with the uses of this advanced equipment.





Glass strands parallel to the air stream as illustrated above offer highly efficient heat transfer and cleaning surfaces.

(1) As a simple air washer, humidifier or evaporative cooler capillary cells call for only 2½ gallons of water per 1000 cfm sprayed at 6 lbs nozzle pressure. Efficient spray washers require 15 to 20 gpm at 20 lbs pressure.

(2) A single stage of capillary cells is equivalent in cooling and dehumidifying capacity to a 2 bank spray type dehumidifier.

(3) Increased cleaning efficiency and an approach of less than 1° F between leaving water and leaving air may be obtained with the Class II Capillary, using counter-flow of air and water.

(4) Where 8 or 10 rows of cooling coils may be required in a simple coil system, a Class III capillary divides the load between 4 rows of coils and the capillary cells. Evaporative cooling is always available and the coils are kept clean.

(5) Where a closed system for the cooling medium is required, (direct expansion, brine or cold water) the capillary cells in advance keep the coils clean and evaporative cooling is always available to economize on refrigeration whenever entering wet bulb temperature allows.

(6) Capillary Conditioners of all types are made in standard sizes ranging from 2000 to 110,000 cfm for central station application. Assembled units including fans, heaters, coils, etc., suitable for suspension or floor mounting range from 3000 to 15,000 cfm.

Submit design and capacity conditions to receive specific recommendations or write for general information.

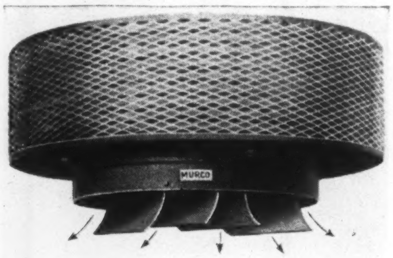
AIR & REFRIGERATION CORP.
11 WEST 42nd ST., NEW YORK CITY, N. Y.
ATLANTA, GA. 268 McDonough Blvd. — CHARLOTTE, N. C. P. O. Box 961 — DETROIT Boulevard Bldg.

a supply of air free of moisture.

The drain is operated automatically by a slight fluctuation of the main line air pressure, a variation of as little as 5 lb being sufficient for its operation. A manual drain is provided for use in periods when the main air line is not in use.—DeVilbiss Co., 300 Phillips Ave., Toledo, Ohio.

Unit Heaters

No. 2034—Vertical projection type unit heaters under the trade name "M Series Murco" have been announced. They are made with an all copper and bronze heating element. The copper fins are metallically bonded to the copper tubes.



These units are made in 11 models. —D. J. Murray Mfg. Co., Wausau, Wis.

Frequency Meter

No. 2035—A new vibration frequency meter, weighing only 8 oz, and designed to aid the engineer in ferreting out the causes and cures of troublesome machine vibrations, is no larger than a slide rule but can indicate what frequencies between 500 and 20,000 cycles per minute are present in a vibrating body.

This compact device is built around the principle of the vibrating reed and consists of a thin spring steel vibrator clamped at one end between a set of steel rollers. A knurled knob connected to the rollers permits their rotation, and moves the steel reed in or out, changing its frequency of vibration. A sliding pointer on the back end of the steel reed indicates the vibrating frequency which is read off the calibrated scale on the frame of the instrument.

To use the meter, its head is held against the vibrating body and the adjusting knob rotated until the vibrator reed moves to and fro at maximum amplitude. If more than one vibrating frequency exists, there will be a point of maximum amplitude for each, and vibrations in differing planes may be detected by changing the axis of the meter.—Westinghouse Electric & Mfg. Co., Research Products Dept., Radio Div., Baltimore, Md.

Odor Removal

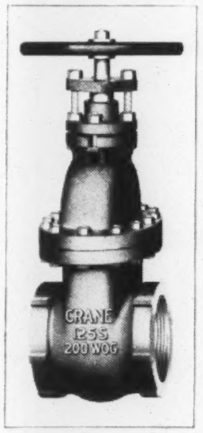
No. 2036—A chemical for counteracting odors in air conditioning work, known as "Airkem," sterilizes the system, destroying organic life on coils, filters and duct surfaces, and also "cancels" odors in the system at the source, according to its manufacturer.

The necessary equipment can be installed in any system in about 20 min, it is said. The necessary cannisters are situated in the duct close to the coils and filters, one cannister being required for each 1000 cfm.

With blowers shut off, the vapors penetrate the system in sufficient concentration to destroy organic growth and counteract odors; during operating periods the content of "Airkem" in the air stream is so small as not to be noticeable to occupants of the conditioned space, it is stated.—Airox Co., 366 Madison Ave., New York, N. Y.

Iron Body Wedge Gate Valves

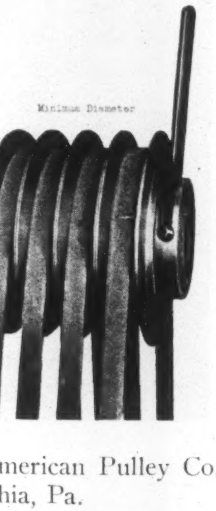
No. 2037—A new line of standard iron body wedge gate valves for 125 lb steam, 200 lb cold working pressure includes both the brass trimmed and the all iron patterns with OS&Y, or non-rising stem, in sizes 2 to 12 in., as well as the quick opening and the underwriters' patterns, the alloy trimmed, alloy cast iron valves for process work, and the standard iron body valves for marine cargo oil systems.



Among the features is the redistribution of body and bonnet materials, which eliminates excess weight and yet complies with all standard requirements, the maker states. Handwheels are of strong malleable iron; deep stuffing boxes permit a generous amount of packing; and the body bonnet joints employ a flat gasket closely bolted together so that gasket compression is evenly distributed.—Crane Co., 836 S. Michigan Ave., Chicago, Ill.

Adjustable Diameter Pulleys

No. 2038—With the new adjustable diameter "Wedgbelt" pulley for varying the speeds on industrial machinery, adjustment can be made in a moment by turning the adjusting collar of the pulley with a spanner wrench, says the maker. As the adjusting collar is turned, the side walls making up each groove are regulated, increasing or decreasing the pitch diameter with corresponding speed changes. On "A" groove pulleys, maximum speed change ranges from 22 to 33 per cent, on "B" groove 18 to 25 per cent, and on "C" groove 15 to 20 per cent. By the use of adjustable diameter pulleys on both the motor and driven shafts, even greater speed variations can be secured.—American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.



Gas Fired Unit Heater

No. 2039—A new line of gas fired unit heaters for use in offices, factories, storerooms and similar places is available in three types, each of which comes in five sizes to provide from 55,000 to 200,000 Btu.

The fan type heater is equipped with a four blade, electrically driven propeller fan. The blower and duct type unit heaters correspond in design and operation to

HANK, WE SAVED $38.00 ON INSTALLATION COSTS ALONE!
THANKS TO THOSE DIRECT-CONNECTED ILG BLOWERS!

EASIER TO INSTALL...
Save Time, Cut Costs!

ALIGNED AT FACTORY

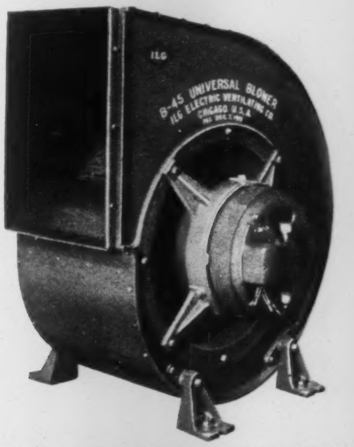
Not only is each unit completely assembled with alignment of motor and wheel "*factory-set*", but each complete blower is factory-tested before shipment on *actual current to be used after installation!* Upon receipt, just remove skids, then bolt legs of unit to platform, floor, wall or ceiling.

STINGY ON FLOOR SPACE

Direct-connection of motor and wheel speeds installation . . . avoids difficulty in cramped quarters . . . ends expense of purchasing and mounting of belts, pulleys and belt guard . . . permits easier mounting on ceiling or wall.

64 UNIVERSAL DISCHARGE ARRANGEMENTS...

The "last-word" in flexibility! 64 standard arrangements available for vertical, horizontal and angle discharges, right and left motor mountings, etc. Full range of motors—standard, drip-proof, water-proof, explosion-proof—for all requirements.



8 DIFFERENT MODELS

. . . with sizes ranging from 9" to 60". Available with Ilg patented Variable Air Controllers and "Floated Drive" Brackets. Every part, including motor, is designed, built, tested and guaranteed by Ilg—*undivided responsibility!*

PHONE OR WRITE TODAY!

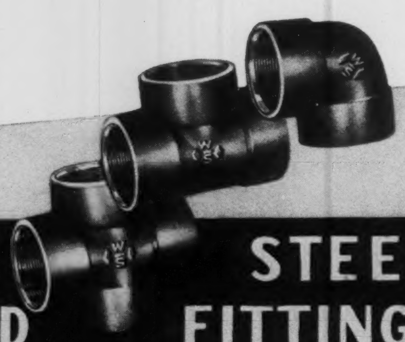
Fully illustrated, 56-page catalog, complete with all necessary data tables, is yours for the asking. Write our main office at Chicago, or phone our nearest branch office today!

ILG
BLOWERS

ILG ELECTRIC VENTILATING CO.
2841 N. CRAWFORD AVENUE, CHICAGO, ILLINOIS

ILG

Vitalized★
VENTILATION
AND AIR CONDITIONING
★ AIR CHANGE... NOT JUST AIR MOVEMENT!



FORGED STEEL
SCREW END FITTINGS

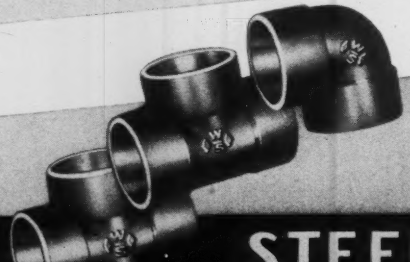
W-S Forged Steel Screwed Fittings are exceptionally strong and rugged. They are bored from solid forgings and threads are long, accurately cut and perfectly aligned. Uniform thickness of walls throughout assures high factor of safety. Long low bands extending beyond the last thread provide added reinforcement.

TYPES—90° Elbows, Tees, 45° Elbows, Crosses, Street Elbows, Laterlas, Couplings, Reducers, Bushings, Caps, Plugs, Unions.

SIZES—1/8" to 4" inclusive. Larger sizes can be made to order.

RATINGS—Made in three classes, 2000 C.W.P., 3000 C.W.P., 6000 C.W.P.

MATERIALS—Forged Carbon, Carbon-Molybdenum, Chromium-Molybdenum (4-6) and Stainless Steel (18-8).



FORGED STEEL
WELDING FITTINGS

W-S Forged Steel Socket Welding Fittings are especially designed for welding and conform to tentative A. S. A. standards. They are easy to use. Just slip the fitting over the pipe end and make a clean outside the pipe weld. No tack welding — no special holding fixtures required.

TYPES—90° Elbows, Tees, 45° Elbows, Crosses, Couplings, Reducers, Caps, Flanged Unions.

SIZES—1/4" to 2" inclusive. Larger sizes can be made to order.

RATINGS—Made in four classes, 2000 C.W.P., 3000 C.W.P., 4000 C.W.P., 6000 C.W.P.

MATERIALS—Forged Carbon Steel and Carbon-Molybdenum Steel. Fittings of forged stainless steel Type 347, can be made to order.

WATSON-STILLMAN

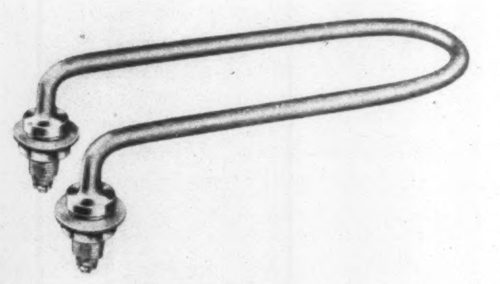
Specifications, dimensions and prices on the complete line are listed in Bulletin A-3.

Write for your copy now—
THE WATSON-STILLMAN CO., ROSELLE, N. J.

the fan type heater except that the blower type is equipped with a blower instead of a fan and the duct type is equipped with neither blower nor fan, being designed for use in a system where the air is supplied by a remotely situated blower of proper capacity for the total number of duct unit heaters employed.

All of the heaters can be furnished to burn natural, manufactured or liquified petroleum gas, and are equipped with automatic controls.—Reznor Mfg. Co., Mercer, Pa.

Electric Immersion Heater

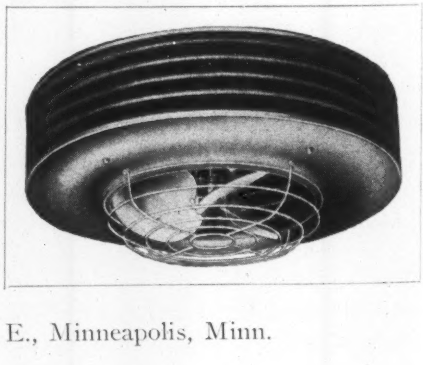


No. 2040—Recent developments have made available a new line of tubular immersion heater units in diameters from 5/16 to ½ in. inclusive and in lengths from 12 in. to 8 ft. These tubular elements are used extensively in water, oil, air and molten metal and molten salt heating.

They are constructed with a helical coil of nickel chromium resistance wire, embedded in a refractory material which is encased in a metal tube. Copper, steel and special high temperature alloy sheathing for operating at a maximum temperature of 1200 F is used, based upon operating conditions of the heating application.—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh, Pa.

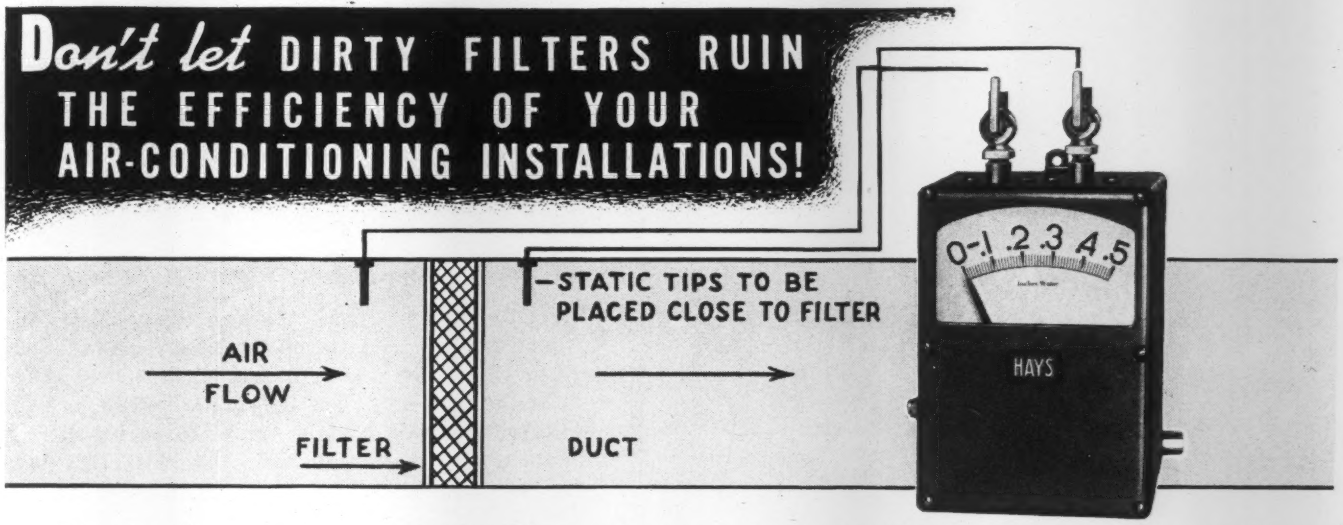
Down Flow Unit Heaters

No. 2041—The down flow unit heater illustrated is particularly adaptable to high ceiling heights. The heating element is designed to operate on steam or forced hot water circulation. All sizes can be supplied with variable speed motors.



This heater is encased in a durable steel round casing finished in brown baked-on wrinkled enamel. —McQuay, Inc., 1601 Broadway, N. E., Minneapolis, Minn.

Don't let DIRTY FILTERS RUIN THE EFFICIENCY OF YOUR AIR-CONDITIONING INSTALLATIONS!


STATIC TIPS TO BE PLACED CLOSE TO FILTER
AIR FLOW
FILTER
DUCT
0-.1 .2 .3 .4 .5
HAYS

Dirt clogged filters in any air-circulating system mean reduced efficiency and added power costs. On the other hand, changing filters oftener than necessary is downright waste.

With a HAYS Air-Filter gage installed in a duct you know precisely, at all times, the condition of the filter and Static tips, installed on either side of the filter bank supply a differential air-flow measurement which is indicated on a scale in the remotely mounted gage. If desired, the gage may be made to flash or sound an alarm when filter resistance becomes excessive. And it is also furnished when wanted with electric contacts to operate a damper to control the flow of air through the duct.

The HAYS Air-Filter Gage employs the famous slack-leather diaphragm pressure measuring element and is of the high quality in design, materials and workmanshp that has made Hays Gages internationally famous. The price is reasonable. Write us at 990 Eighth Avenue for Publication 40-278.

The HAYS CORPORATION
SINCE 1901
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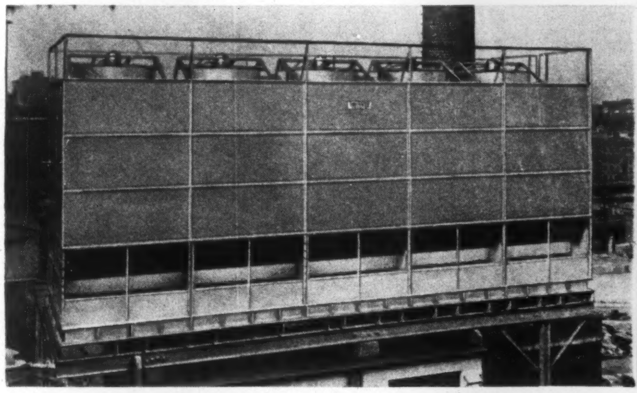
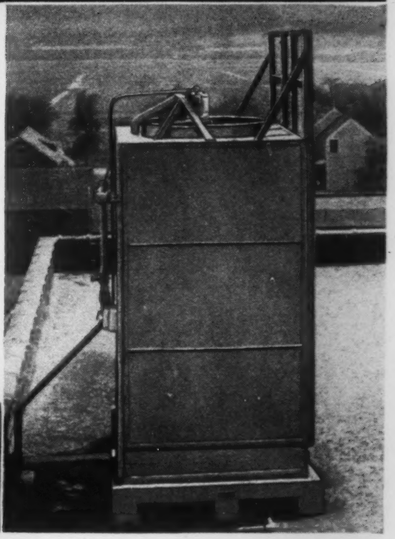
MICHIGAN CITY, INDIANA, U.S.A



BIG OR SMALL *Binks* HAS THE RIGHT COOLING TOWER



There is a BINKS cooling tower for every size and type of air-conditioning installation. The towers illustrated here are of the highly efficient BINKS Induced Draft design. These towers are capable of constant heavy duty . . . are independent of natural wind movements . . . produce consistently lower final water temperatures . . . and occupy less space than regular atmospheric towers. However, these are but one type of equipment made by BINKS.

WRITE TODAY for a complete water cooling catalog and data book. It's a valuable addition to any technical library.

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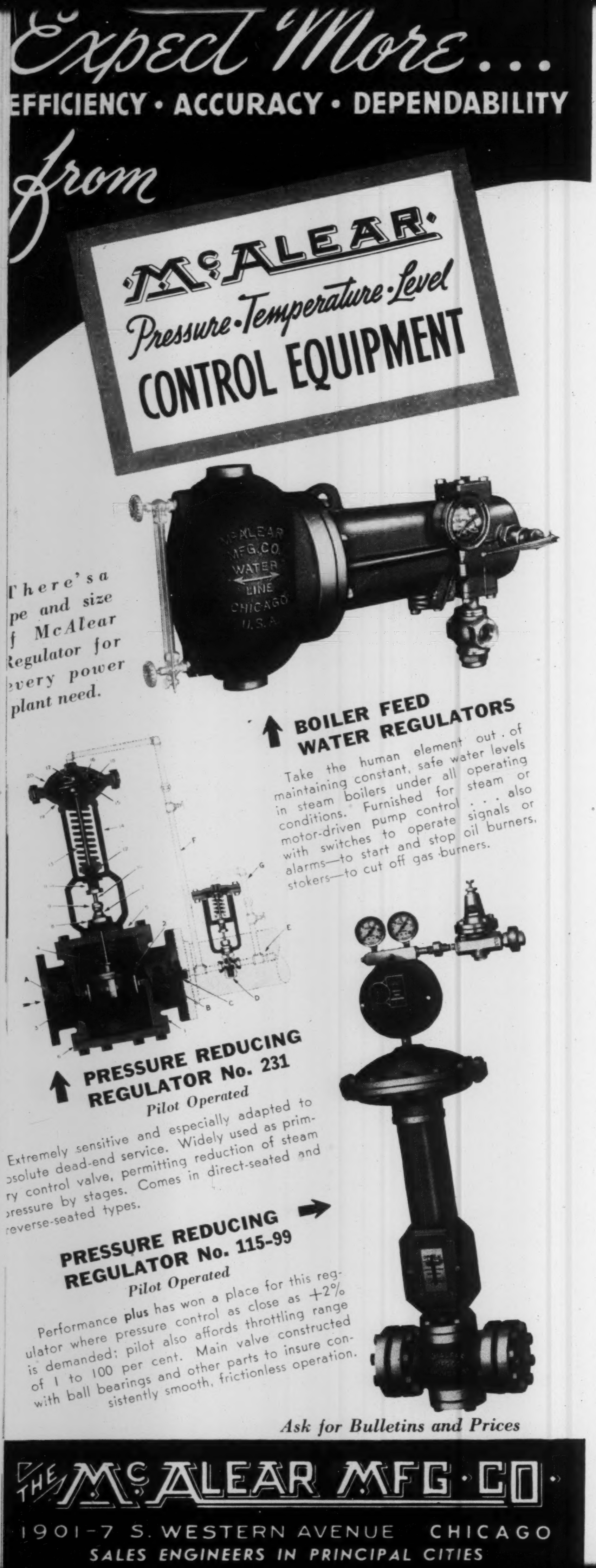

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CONTROL EQUIPMENT

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very power
plant need.

BOILER FEED WATER REGULATORS

Take the human element out of maintaining constant, safe water levels in steam boilers under all operating conditions. Furnished for steam or motor-driven pump control . . . also with switches to operate signals or alarms—to start and stop oil burners, stokers—to cut off gas burners.

PRESSURE REDUCING REGULATOR No. 231
Pilot Operated

Extremely sensitive and especially adapted to bsolute dead-end service. Widely used as primry control valve, permitting reduction of steam ressure by stages. Comes in direct-seated and everse-seated types.

PRESSURE REDUCING REGULATOR No. 115-99
Pilot Operated

Performance **plus** has won a place for this regulator where pressure control as close as +2% is demanded; pilot also affords throttling range of 1 to 100 per cent. Main valve constructed with ball bearings and other parts to insure consistently smooth, frictionless operation.

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SALES ENGINEERS IN PRINCIPAL CITIES

Housing and National Defense

[The following paragraphs have been taken from a luncheon address by Charles F. Palmer, National Defense Housing Coördinator, before the Metropolitan Housing Council, Chicago, on November 15. They are of special interest because of Mr. Palmer's official position.]

THE problem of emergency defense housing can be illustrated by referring to the situation around Wilmington, Ill., where a powder and loading plant is being built. If the war ends in a satisfactory peace, this plant will undoubtedly close. We have no desire, therefore, to create a future ghost town by building new houses for all the workers, or for any of them if it can be avoided. The housing program there dissolves into a problem of transportation from Joliet, South Chicago and the surrounding country where unemployed workers are living.

This example illustrates the method of approach to the emergency problem of housing defense workers and their families. First, by making a survey of available labor, we see whether workers can be obtained who do not have to change their residence. Second, by a registration of vacant houses, apartments and rooms, we see how many imported workers can be accommodated in the existing housing. Next, we survey the possibilities of encouraging private enterprise to build whatever housing seems to offer a fair prospect of commercial soundness. And last of all, if housing must be built, and if private enterprise cannot or will not do it, the government will build it as a war expenditure, not wasting any money but not looking for any profit.

Defense Housing Need

The total defense housing need will probably run to about seven hundred million dollars of new construction. We have some $290,000,000 of public money available, but we hope that roughly $500,000,000 worth of construction will be done by private initiative.

On private housing work, the government has an important part to play by way of insurance, through the Federal Housing Administration, the Federal Home Loan Bank Board and the Federal Deposit Insurance Corp., which serve to reduce the overhead risks of capital investment, lower the necessary return required to cover risk and thereby widen the field in which private investment can safely venture.

The government is also interested in preventing so far as possible the runaway material costs that we saw in World War I. Insofar as speculative price rises and local rackets are controlled, the field of private enterprise will of course be correspondingly widened. You probably recall how the effects of high prices and rackets 25 years ago practically blocked all new building for a time. As to the matter of material supplies, we are not yet at the point of being obliged to adopt serious restrictions on the use of building materials to protect defense work.

Where private building cannot supply the necessary housing for efficient expansion of defense industries, the federal agencies are prepared to step in. The navy is handling its own housing, building by private contract.

The army work and most of the industrial public housing will be handled by the Public Buildings Administration, also under private construction contract. Some of the current work of the United States Housing Authority is specifically for defense. Another agency, recently formed, is the Defense Homes Corp., engaged largely in construction of projects to be sold later to private investors.

It is to be noted that on so-called public housing only the risk function and the management of the property are public enterprise; the contractors, the subcontractors, the material dealers and the workers are all private enterprisers.

Shifting Tax Burden

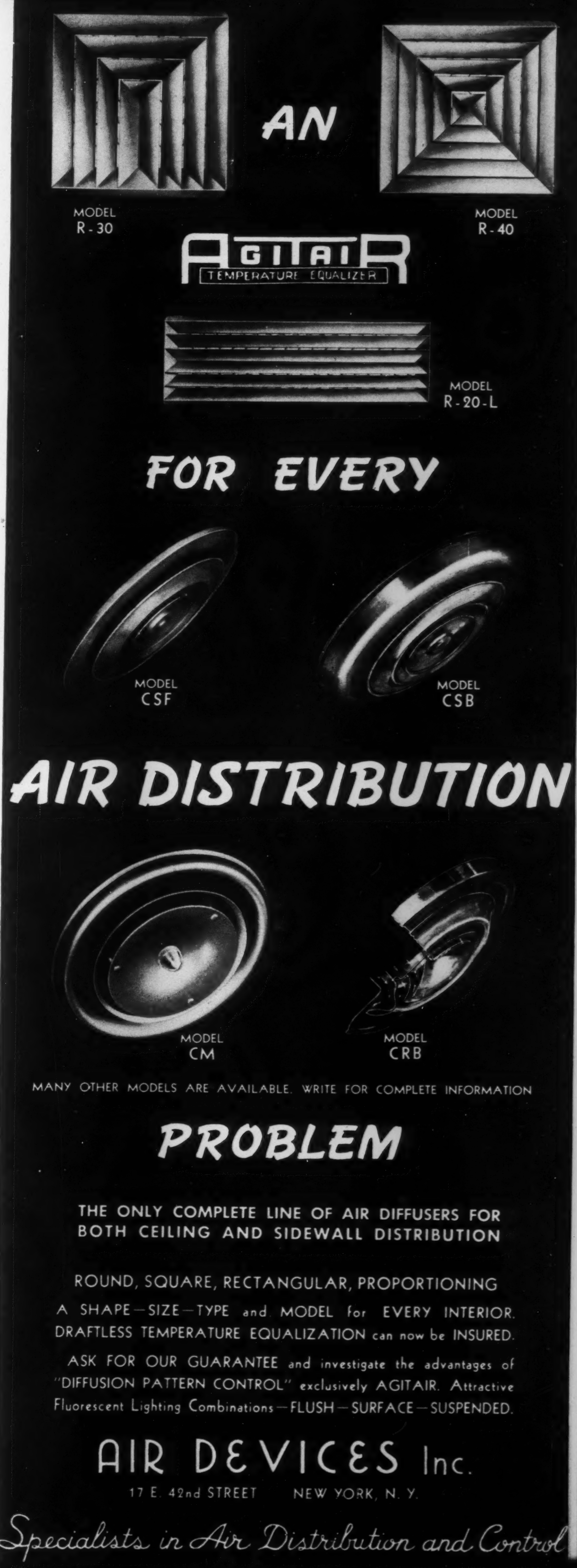
Another general factor in public policy should be recognized as having an important bearing on the whole real estate situation in the United States. That is the trend toward shifting the tax burden from real estate to personal and corporate incomes. In one of our large cities, I am informed, one-half of the total expenditures for what used to be local government functions are now paid by state and federal funds. This tax shift has been made under pressure, because local tax structures were breaking down under the relief burdens of the depression. But once established, the trend continues, and may be expected to throw more and more of the public expense on the federal government, actually relieving local real estate, in the future, of a part of its customary tax load.

The effect of this trend, which is a result of unavoidable changes in our fiscal system, will undoubtedly be to reduce the risks in future real estate operations, and to make possible the rebuilding of cities at a smaller net cost to the public. In particular, we can expect that in any future depression the relief load will not again be thrown entirely upon the real estate owner as it was in 1930 to 1932, and the risk of intolerable losses in real estate will therefore be smaller.

Slum Clearance

We must recognize that the defense of our country is not entirely a matter of airplanes and ships, though they come first. In the total war of today, total defense is the only way to be secure, and where nations are fairly well matched in armament, the final decision goes to the nation with the most sticking power, or guts. Now sticking power is not something created out of thin air. It is made up of the judgment of the people as to whether their country is worth dying for. And slums are a standing argument, grinding into the hearts and minds of millions of people, that their country is not worth much to them. If they hold out against that evidence, and still love their country, the argument is still there, wearing them down. It had better be removed before it does any more harm.

Do you remember a few weeks ago, in the bombing of London, the story that the slum dwellers were saying that the upper classes had deeper and safer shelters? That was a danger sign. The king and queen met it by going about among the poor and risking their own lives. But though the danger passed, the lesson remains. Slums are a weapon of the enemy, already lying between our ribs waiting to be twisted.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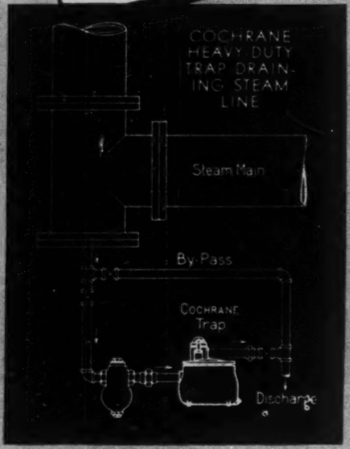
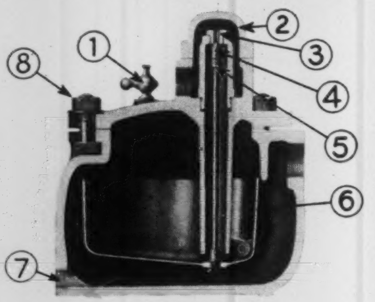
COCHRANE *Drainage* EQUIPMENT



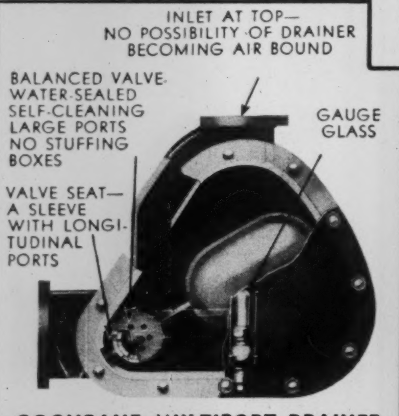


COCHRANE HEAVY-DUTY STEAM TRAP

1. Air removal vent cock
2. Removable valve bonnet
3. Easilychanged valve seat
4. Stainless steel valve
5. 4 centering arms
6. Large displacement bucket
7. Opening for drain or blow-off
8. Bolts for easy accessibility

ADVANTAGES

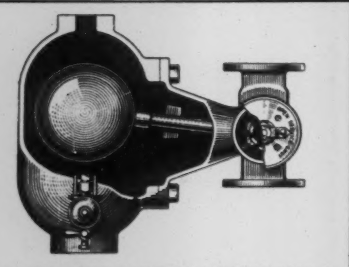
Onlv eight parts. Large cast-iron bucket holds valve tightly to seat until water overflows rim, opening valve wide. No levers, restricted passages or stuffing boxes to become clogged. Seat easily changed for various discharge rates. Write for Publication 2850.


INLET AT TOP—
NO POSSIBILITY OF DRAINER BECOMING AIR BOUND
BALANCED VALVE WATER-SEALED SELF-CLEANING LARGE PORTS NO STUFFING BOXES
GAUGE GLASS
VALVE SEAT—A SLEEVE WITH LONGITUDINAL PORTS

COCHRANE MULTIPORT DRAINER

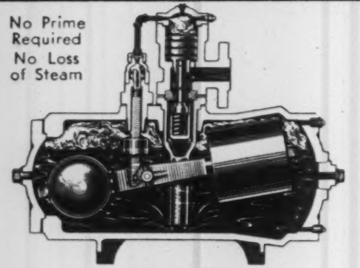
A low pressure drainer especially suited for operation at low differential pressures because of its very large port areas which provide a tremendously large discharge capacity. It uses a rotating cylindrical valve, directly attached to the float stem. Publication 2925 gives details.

COCHRANE LOW PRESSURE DRAINER DRAINING HEATING COILS
Heating Coil
Cochrane Drainer
Discharge
By-Pass



MULTIPORT DRAIN REGULATOR

Discharge regulated by height of condensate in body. Exceptionally large capacity.



DISCHARGER

For removing large quantities of condensate under high pressure (150 to 2000 lb./sq. in. or higher).

COCHRANE CORPORATION • 3131 N. 17th ST., PHILADELPHIA, PA.

COCHRANE

WATER SOFTENERS • STEAM SPECIALTIES • DEAERATORS • FLOW METERS

So do not think that any effort to improve housing conditions is wasted now, merely because the big noise is in the military defense program. We are thankful now for every bit of slum clearance we have already accomplished. We wish we had done more of it while there was time. We cannot possibly hope to get rid of all our slums in 1941 as a defense measure. But if we show a vigorous spirit of active interest in bettering the condition of the low income groups, the rewards in heightened morale will be more than worth the price. I hope, therefore, that every effort will be made to improve housing conditions in every American city even during the defense crisis.

When Peace Comes

And what about the time after the war? As every one knows, the peace, for which we all hope and pray, will bring with it a collapse of war prosperity, as it did in 1921. Then what do we do? Shall we sit around and let the unemployed wallow in post-war depression until they grow angry and start a post-war revolution? I do not think so. We have had some experience with depressions and our government is likely to take a hand with little or no delay.

The problem that we shall face will be what to do with some millions of men, and corresponding quantities of machinery and materials, that are suddenly thrown into idleness by stoppage of the defense program. We should be thinking about that, for we do not know when that day will come.

As real estate men and people interested in housing, I submit the thought that we should be making plans to propose a program of rebuilding, to use the idle men and materials after the war. Let us get set to go after the slums this time with the throttle wide open. If a favorable peace comes, it will be a new world with the sun coming up; let us be ready to rebuild our cities to suit the bright future. That is not the whole answer to the problem of post-war collapse, but it is our part of the answer. I leave that thought with you as something I believe is worth your careful consideration and active support.

Book Reviews

Electric Current Characteristics

[World Directory of Electric Current Characteristics, compiled by E. S. Moore. 1st ed. 1940. 62 lithographed pages, 8½ x 11 in., paperboard cover. Published by E. S. Moore, c/o Century Electric Co., 1806 Pine St., St. Louis, Mo. Price $5.00.]

The information compiled in this directory has been accumulated by the author over a period of 20 years of activity in export sales of electrical motors and generators, which has included travel in practically all countries of the world. This is believed to be the first publication giving the data in brief, compact form.

Arranged alphabetically by countries and cities, the directory indicates for each city the frequency and voltages for single phase, three or two phase, and for direct current if any; in many cases the kilowatt capacity of the plant or plants supplying current is shown. Data cover-

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PERFORMANCE

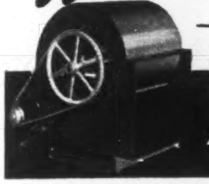
BLOWER WHEELS . . .
COMPLETE BLOWER
ASSEMBLIES

Lau Blower Wheels for example are dynamically balanced with unerring accuracy with this machine built specially for Lau. It assures perfect balance, smooth running, quiet operation of the Blower, plus longer life for bearings and the entire assembly.

But this is only one of hundreds of proving and testing operations adopted by Lau to assure highest precision and advanced standards of operation.

There are sizes of Wheels and Complete Assemblies to meet every requirement.

Write **LAU BLOWER CO.**
2015 Home Ave., Dayton, Ohio



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AIR CONDITIONING
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FORCED CONVECTION UNITS
EVAPORATIVE COILS
PIPE COILS

Let's talk it over at the
ALL INDUSTRY SHOW—CHICAGO
January 13-16, 1941

BOOTH
41

ACME INDUSTRIES, INC.
JACKSON MICHIGAN

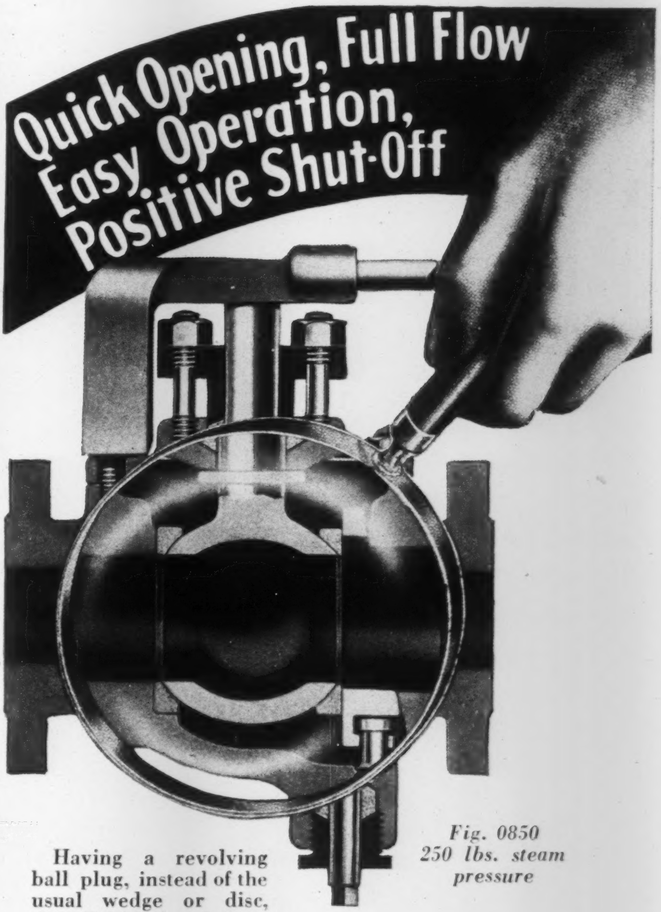

Fig. 0850
250 lbs. steam
pressure

Having a revolving ball plug, instead of the usual wedge or disc, the Fairbanks Sphero offers many advantages possessed by no other valve.

It positively eliminates frictional resistance to stream flow, as the round opening in ball plug is the same size as that in the pipe. When the ball plug is opened or closed, it wipes seating surfaces clean. Its shearing action cuts through heavy solids and liquids that would cause ordinary valves to stick and jam. There is nothing on which scale or foreign matter can accumulate.

A positive shut-off is assured as the seat rings form a perfect fit with the ball. A wedge permits adjustment to make the seat rings absolutely pressure tight. And wear on seat rings is reduced to a minimum by the rotary movement of the ball.

A quarter turn of the lever handle opens or closes the valve "as quick as a wink". And you can always be certain that it is fully open or shut tight because it has a positive stop.

When seat rings or other parts become worn, they can be replaced without removing the valve from the line.

No other valve gives such ideal service for blow-off purposes or where a full-flow, quick acting valve is required.

Write now for catalog No. 21 and name of our nearest distributor.

THE FAIRBANKS CO.

Valves, Dart Unions, Hand Trucks and Wheelbarrows
396 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.—Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks Sphero Valves

Direct-Drive Ammonia Units, 1/2 Hp.
Low Pressure Units 1/4 to 15 Hp.
Freon-12 Units, 10 to 30 Hp.
4 Large 2-Cyl. Frick Compressors in Air Conditioning Service at the Phileade and Philtower Buildings, Tulsa, Oklahoma.
Type AV Ammonia Units 25 to 30 Hp.
Freon-12 Compressors in 6 Sizes
Ammonia Compressors in 10 Sizes
Booster Compressors in 6 Sizes
Carbon Dioxide Compressors in 6 Sizes
Large 4-Cyl. Compressors in 5 Sizes

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Because there's always a Frick machine of the type and size to suit your needs exactly. And 58 years' experience is built into every one of them—your assurance of dependable, profit-making operation.

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ing principal cities in 129 different countries and islands are included.

The information is of value in checking specifications given in inquiries and orders and as a guide in offering electrical equipment to various countries.

Pumps

[Pumps—Types, Selection, Installation, Operation and Maintenance, by Frank A. Kristal and F. A. Annett. 1st ed. 1940. 339 + xv pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $3.50.]

This new volume is a practical treatment of pumping problems for the designer, manufacturer, sales representative, operator and student. Types and designs of pumps are described and such important applications as boiler feed, deep wells, sumps, and sewage are given detailed treatment.

The authors tell what may be expected by way of performance of the various types as well as indicating their service limitations. The subjects of installation, operation and supervision, as well as troubles and their remedies, are given particular attention.

Research Data

The American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, N. Y., issued last month an Outline of Research Facilities and Bibliography of Research Reports. It has been compiled, according to A. E. Stacey, Jr., chairman of the society's research committee, to assist those engineers and technicians engaged in national defense efforts to locate quickly data on various phases of heating, ventilating and air conditioning.

Coming Events

Louisiana Engineering Society: Annual meeting, January 10-11, St. Charles Hotel, New Orleans, La. Program includes papers on radiant heating and cooling by F. E. Giesecke, and solving the dust and dirt problem electrically by S. R. Orem, Jr. Secretary-Treasurer, A. M. Hill, 422 St. Charles Hotel, New Orleans, La.

"All-Industry" Refrigeration and Air Conditioning Exhibition: January 13-16, Stevens Hotel, Chicago, Ill. Sponsored by Refrigeration Equipment Manufacturers Association, R. M. McClure, executive secretary, 111 W. Washington St., Chicago, Ill.

National Air Conditioning Association: 1941 convention, January 13-15, Blackstone Hotel, Chicago, Ill. Arthur F. Callahan, executive secretary, 220 E. 42nd St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 27-29, Hotel Muehlebach, Kansas City, Mo. A. V. Hutchinson, secretary, 51 Madison Ave., New York, N. Y.

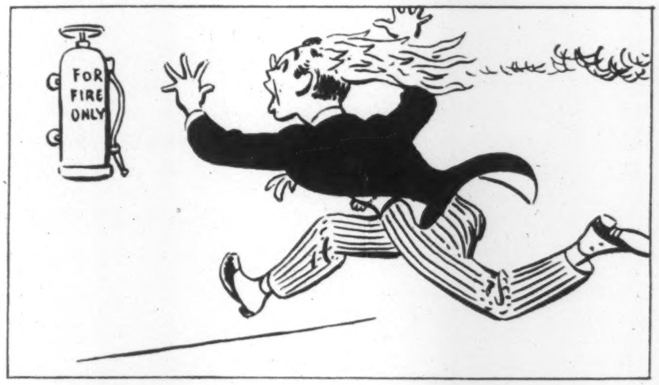
National Oil Burner Progress Exhibition: March 17-22, Commercial Museum, Philadelphia, Pa. Official hotel headquarters, Hotel Benjamin Franklin. Sponsored by Oil Burner Institute, 30 Rockefeller Plaza, New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, June 3-5, Ambassador

Points to remember...when you specify air filters!

1. Your Treasurer will be tickled to death, if you specify Dust-Stop* Air Filters. They cost about 1¢ per CFM to install, including frames. And that's not all! They set you back the trifling amount of about 1/10 cent per CFM when they need changing!

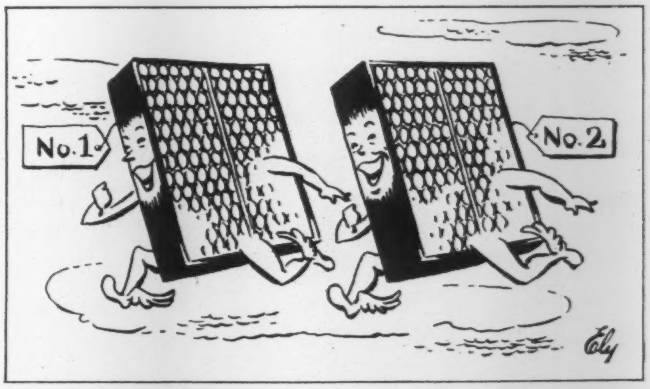
2. And, boy! Do Dust-Stops call the score on dust! They keep out virtually all the "nuisance" varieties. Capacity: 2 CFM per sq. inch of area at 300 FPM. Average resistance, new (in inches of water gauge): .065 for 1-inch; .125 for 2-inch Dust-Stops.



3. You need never have fire on your mind, with Dust-Stop Air Filters. *Neither* the glass-fiber filtering medium nor the patented adhesive will support combustion! Dust-Stops are safer because the fire hazard just doesn't exist!

4. Nor will anybody be able to make a goat out of you because of adhesive droplets inside the duct system, or on the walls. Dust-Stops positively will not bleed! That's another advantage you *have* when you use these replaceable filters.

5. Changing Dust-Stops is about as hard as changing your face from a frown to a smile. No skilled labor required. No draining, recharging, or supervision needed, either. And no need to keep a supply of spares. Dust-Stops fit most types of air systems.



6. Dust-Stops will come to you quickly, if you'll just phone your air conditioning manufacturer, jobber, or dealer. You can choose either the No. 1 (1-inch) or No. 2 (2-inch). Or write to Owens-Corning Fiberglas Corporation, Toledo, Ohio. In Canada: Fiberglas Canada, Limited, Oshawa, Ontario.

FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U. S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

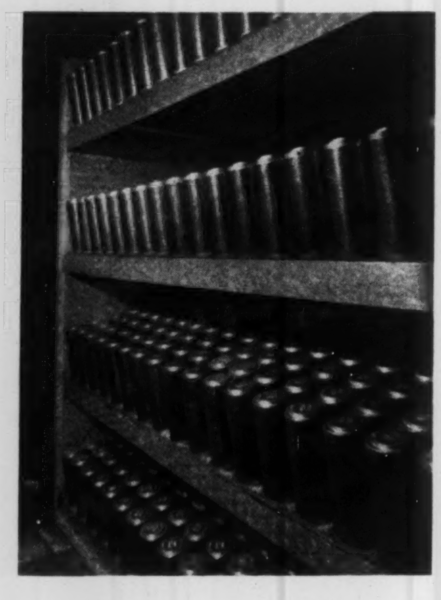
DIRECT CANADIAN INQUIRIES TO FIBERGLAS CANADA, LIMITED, OSHAWA, ONTARIO

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Odor Adsorbers

No. 2042—The new Stouffer restaurant recently opened at 3 E. 57th St., New York City, has a "good neighbor" policy of its own. "Dorex" odor adsorbers are installed in the kitchen exhaust duct to trap cooking odors and fumes before they can escape to the surrounding buildings.



The installation treats 23,000 cfm of exhaust air, adds a resistance of but 0.14 in. water to the system. A total of 864 canisters containing activated coconut shell carbon are used. This specially processed carbon has the ability to adsorb and hold gases and vapors equal to 20 per cent of its weight, according to the manufacturer. Upon saturation the carbon is reactivated.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

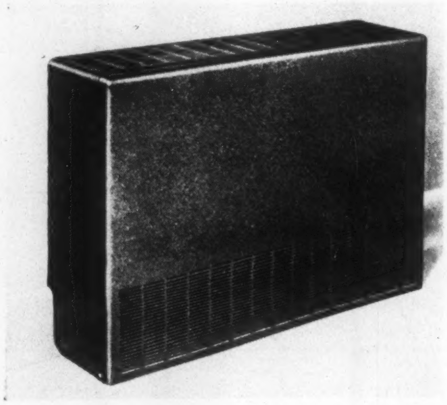
Venturi Type Fan Housing

No. 2043—A pressed steel fan housing, with the venturi section drawn down in one operation, is now available as a standard item.

Designed in a popular range of sizes and gages for exhaust and ventilating fans and unit heaters, it offers features that decrease cost and increase fan efficiency, according to the manufacturer. It is said to eliminate the necessity of expensive tooling for fan housings on the part of the manufacturer and is available to the contractor as a standard assembly unit in new or old installations.—The Commercial Shearing & Stamping Co., 1775 Logan, Youngstown, Ohio.

Cabinet Unit Heater

No. 2044—The new cabinet unit heater illustrated is designed for the heating of offices, lobbies, stores, showrooms, corridors . . . wherever quick uniform distribution of heat combined with quiet operation is required, the maker states. It incorporates quiet blower fans, motor and heating coil in one unit. All piping and electrical connections are made within the cabinet enclosure.



Enclosures are stamped from 18 ga furniture steel and sprayed on the interior with a heavy coating of sound deadening acoustical mastic. For rust protection, cabinets are factory bonderized after fabrication, and before application of the tobacco-brown wrinkle finish.

These heaters are made in five types of enclosures (floor, wall, inverted wall, ceiling, and recessed types) and in three capacities ranging from 105 to 450 sq ft of radiation.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Pipe Intersection Cutter

No. 2045*—The new "Fall-O-Matic" pipe intersection cutter will cut any size pipe to fit any pipe of the same size, or larger, at any angle or any offset, the maker states. On the right of the picture (p. 106) is a sample of the work that it does; in the machine is shown a piece of 6 in. pipe that has been cut to fit an 8 in. pipe at an angle of 45 deg, with a 1 in. offset.

The adjustments are made by four dials, two of which can be seen at the top of the carriage. (The cutting is accomplished with a standard cutting torch as shown.)

The machine is hand operated because the compound

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Heating, Piping and Air Conditioning, [2-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested):

2042 2043 2044 2045 2046 2047 2048 2049 2050 2051
2052 2053 2054 2055 2056 2057
3766 3767 3768 3769 3770 3771 3772 3773 3774 3775
3776 3777 3778 3779 3780 3781 3782 3783 3784 3785
3786 3787 3788 3789 3790 3791 3792 3793 3794 3795
3796 3797 3798 3799 3800 3801 3802 3803 3804 3805
3806

Name .... Title ....
Company ....
Address ....
City .... State ....

Another G-E INSTALLATION IN THE HUGE WALT DISNEY CITY

Besides air conditioning the 250,000 sq. feet in his new Burbank, California, studios last year, Walt Disney has installed G-E commercial refrigeration equipment in coffee shops, restaurants, cafeterias, sandwich bars, and ice cream fountains. These unusual installations further insure the comfort and well-being of Mr. Disney's 1000 employees.

Makes little difference whether a city's called Burbank or Bangkok, most anywhere you go you will see G-E commercial refrigeration doing a good job. Like others, you too will find General Electric equipment (heating, air conditioning, refrigeration, etc.) meets the most exacting requirements.

Because G-E is throwing its full support behind engineers, architects and contractors, equipment of 5 tons and over is now sold direct to qualified contractors. For information, write to General Electric, Div. 255, Bloomfield, N. J.

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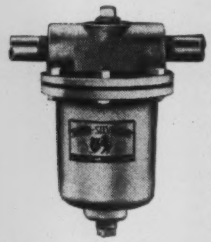
FOR HEATING, AIR CONDITIONING
AND COMMERCIAL REFRIGERATION

UNTANGLE *that*
RED TAPE PIPING

Traps sketched here are old style 1931 model Anderson steam traps with their piping. Below is a photo of the present model Anderson Super-Silvertop trap showing simplified piping.

with ANDERSON SUPER-SILVERTOPS



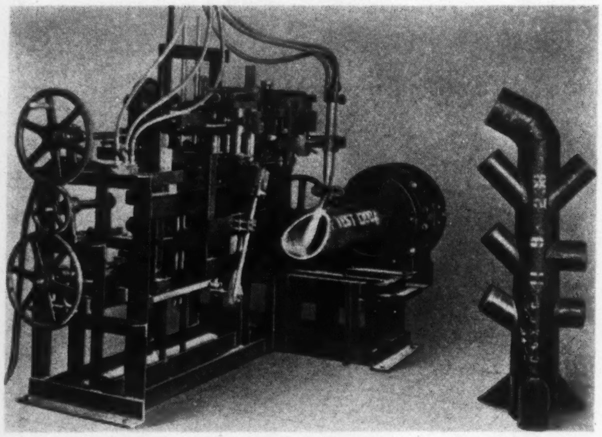
Why bother with "Red Tape" piping when you can untangle the jumble with Anderson Super-Silvertop—the straight-in-line inverted bucket steam trap? This engineered steam trap has the U-tube built into the trap—you don't have to make it yourself. That permits using the trap straight-in-line or as an elbow—no extra fittings to buy or install. Result?—neater piping layout and a saving of as much as seven fittings and an hour of installation time *per trap!*

Anderson Super-Silvertops also have greater condensate capacity, since a larger bucket and longer lever arm easily open a larger valve orifice and open it wide—the two essential items that determine trap capacity. In addition, Super-Silvertops have a record of long service life, positive operation, ease of inspection (trap stays on the line), exceptional valve life and are backed by fifty-five years of steam trap manufacturing experience.

Find out more about Anderson Super-Silvertop, the inverted bucket trap with simplified piping—send for your copy of the helpful book, "How To Choose a Steam Trap." Even if you don't use Super-Silvertops, you'll find this book valuable; write today.

THE V. D. ANDERSON COMPANY
1949 WEST 96th STREET • CLEVELAND, OHIO

Super-Silvertop
STEAM TRAPS

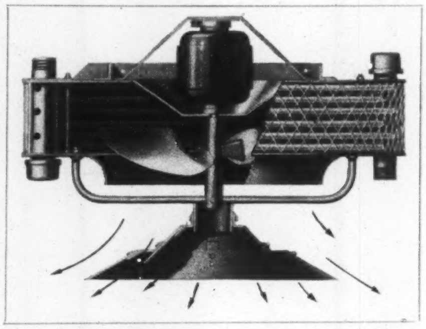


motion changes the cutting speed to such an extent that the operator must gage the speed to match the torch's ability to cut. The chuck opens up, and has a set of adapters for each size of pipe. The adapter is the crescent shaped object with two holes in it.

An attachment can be supplied that will cut the corresponding holes in the other pipe.—Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.

Unit Heater

No. 2046—"Downblast Speed Heater" is the name of a new unit heater recently developed to supplement the manufacturer's line of floor type and standard type suspended heaters. As its name implies, it projects heat directly downward, resulting in more efficient heating for certain installations, according to the maker. It is particularly suited for installation in buildings with high ceilings, above crane rails, or wherever an unusually high installation is desired. The largest size will provide effective heating even when suspended 40 ft above the floor level, it is stated.



Structurally, the heater consists of a circular extended surface heating element protected by a screen guard, with copper tubes brazed into copper headers forming a homogeneous unit. The fins are aluminum. Air is drawn into the heater through the heating coil and projected downward by an aluminum fan with three die stamped blades riveted to a cast hub. Headers on both sides of the coil permit rapid clearing of condensate. Headers have threaded connections at either end, allowing steam lines to be connected to whichever side is most convenient.

Twelve sizes of these heaters are available, with capacities ranging from 40,000 to 400,000 Btu per hr at 2 lb steam, 60 deg entering air.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

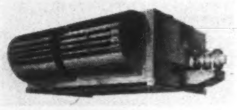
Licensed Under Auditorium Patents

No. 2047—According to a recent announcement, the Trane Co., La Crosse, Wis., has taken out a general

WARM AIR INDUSTRIAL HEATING

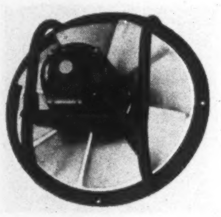
with

Directherm (*Direct Fired*) Heaters
(For Oil, Gas or Coal)



Airtherm Steam Unit Heaters.

Write for special data prices on Airtherm Steam Unit Heaters . . . a complete line for floor, wall or ceiling mounting . . . including the Airblanket design . . . a new style of unit heater with a patented method of air direction control. Airblankets are especially suited for high ceiling jobs.



Air-Vent Exhaust Fans . . .

. . . to meet industrial and general requirements for a rugged, heavy duty type fan of simplified construction.

ENGINEERING SERVICE

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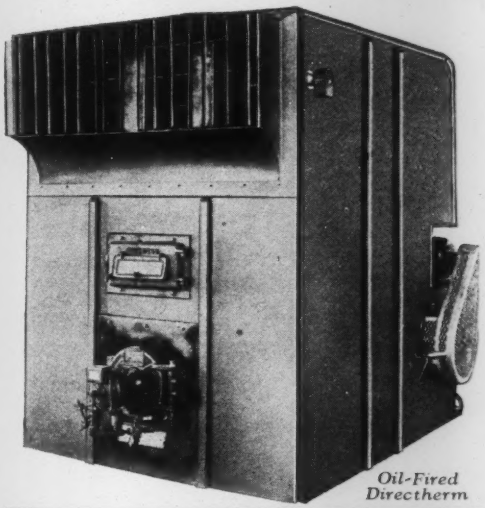
The Directherm, direct fired heater, is solving the heating problems for expanding industry everywhere. Heating engineers and industrial architects recommend modern warm air industrial heating. The Directherm is the answer. Designed for direct discharge or with duct work.

Investigate the Directherm Now . . . if you are building or contemplating building a new plant or additions to your present plant capacity. Get complete details by writing today. Ask for bulletin No. 305A.



Oil-Fired Directherm

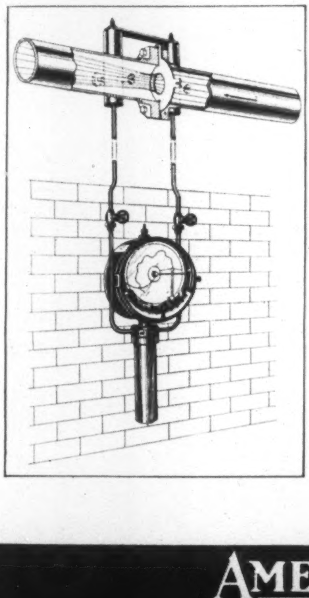
SIX STANDARD SIZES
300,000 to 1,700,000 Btu's

Directherm Direct Fired Unit Heaters are available in six standard sizes with capacities ranging from 300,000 to 1,700,000 Btu's. The units are made up of heavy steel plates, sheets and sections, with all welded joints throughout. Nothing to loosen and permit variation in quantity of combustion air. Readily cleanable flue gas header to maintain high combustion efficiency.

AIRTHERM MANUFACTURING COMPANY • 712 S. SPRING • ST. LOUIS, MO.

The ADSCO FLOW METER, Orifice Type

ACCURATELY METERS STEAM, WATER, COMPRESSED AIR OR GAS.
SIMPLE IN CONSTRUCTION - - EASILY INSTALLED



Free Floating, Frictionless Meter Mechanism transmits flow to direct-reading, evenly-divided chart

The ADSCO Flow Meter has a record of exceptional accuracy at all rates of flow. It is highly sensitive to fluctuations in flow but cannot be damaged by sudden overloads or reverse flows. Simple and rugged in construction—easily installed and maintained—requires no frequent inspection or adjustments.

Available with recording chart, indicating scale and integrator counter to totalize the flow or in other combinations of these three devices.

Correspondence is invited regarding your metering problems so that ADSCO may make recommendations based on over 25 years experience in the manufacture of meters.

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AMERICAN DISTRICT STEAM COMPANY

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For Municipalities, Industries, Railroads, Mines and Irrigation

license to use the patents of the Auditorium Conditioning Corp., which patents cover inventions "effecting substantial economies in the design and operation of air conditioning equipment."

The announcement states that the Trane Co. joins a list of licensees which includes such prominent manufacturers as Carrier Corp., York Ice Machinery Corp., General Electric Co., Westinghouse Elec. & Mfg. Co., B. F. Sturtevant Co., Frick Co., J. O. Ross Engineering Corp., American Blower Corp., Buffalo Forge Co., Clarage Fan Co., and many others. These companies have been manufacturing and installing air conditioning systems under the many Auditorium patents on temperature, humidity and air circulation control.—Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.

Fan Patents

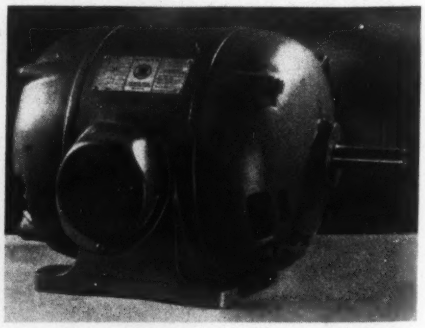
No. 2048—Purchase of patents covering design and methods of producing pressed steel (cup type) blower wheels has been announced by The Torrington Mfg. Co. The patents were acquired from the American Blower Corp.

All tools required for the manufacture of these centrifugal fans and an inventory of parts are included in the transfer. The numbers of the patents are 1,513,763, 1,648,060 and 1,913,591. Torrington has for several years been manufacturing these fans under license from American Blower.

The photo shows E. Bryan Williams (left) and Philip Nigro, research engineers, conducting a special NAFM test, using the newly designed "Airotor" blower wheel in a customer's housing.—Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.

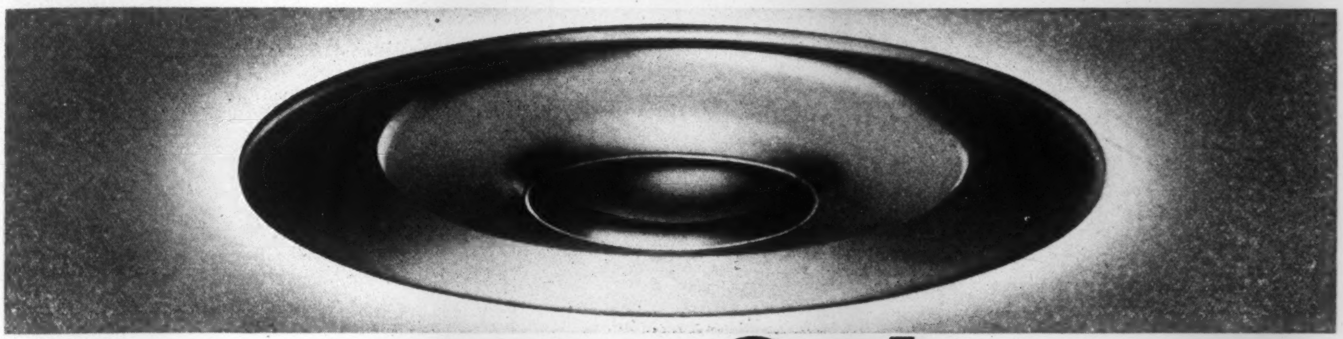
Induction Motors

No. 2049—New, smaller, a-c, squirrel cage, ball bearing induction motors—especially designed for general purpose industrial, machinery drive applications — are available in ratings from ½ to 5 hp, with speeds from 875 to 3600 rpm, for operation on 110, 220, 440, and 550 volts, 2 and 3 phase.



Featuring the

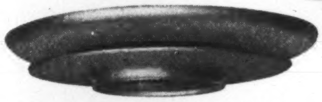
SCIENTIFICALLY *Proved* PERFORMANCE



FLUSH TYPE

venturi-flo-lite

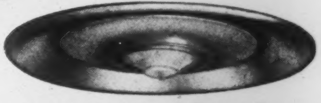
CEILING OUTLETS



SURFACE TYPE

Two principal designs of VENTURI-FLO units are available — Flush or Surface types, as shown. The choice is a matter of appearance only, as both give similar performance.

In numerous tests, under both service and laboratory conditions, the superiority of VENTURI-FLO Draftless Air Distribution has been conclusively shown. Greater aspiration capacity provides more thorough diffusion and room-wide uniform temperature.



venturi-flo-lite

Where a combination lighting fixture and air distribution outlet is desired, specify one of several models of VENTURI-FLO-LITE for greatest beauty and efficiency.

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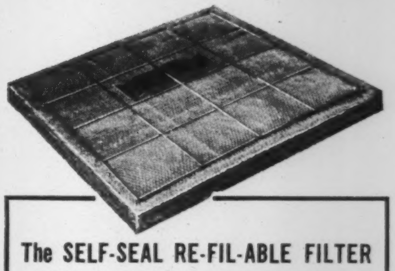
RESEARCH AIR FILTER

PROTECTS PERFORMANCE, IMPROVES OPERATION

BECAUSE THEY STOP MORE DUST, HOLD MORE DUST, and OFFER LESS RESISTANCE TO AIR FLOW!

RESEARCH Air Filters No. 200 Series protect the performance and promote efficiency in heating and ventilating equipment because they are designed for easy, economical filter pad replacements . . . and frequent filter replacement improves operation and protects performance. Filter pad is sandwiched between two wire grids which hook together. Pad extends snugly to sides of air passageway to seal tightly. When filter pad is dirty, grids are unhooked and a new pad inserted. Dealers like the extra profits from this easy replacement service.

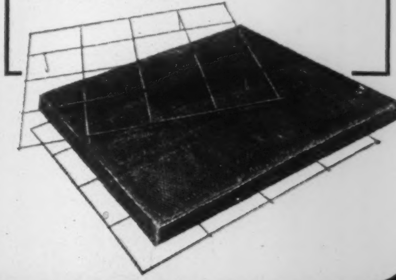
Write for **DATA SHEETS** *on the complete* **RESEARCH** *Filter Line.*



The SELF-SEAL RE-FIL-ABLE FILTER

ABOVE: The assembled No. 200 Series RESEARCH FILTER used in warm air furnaces, air conditioning units and filter banks.

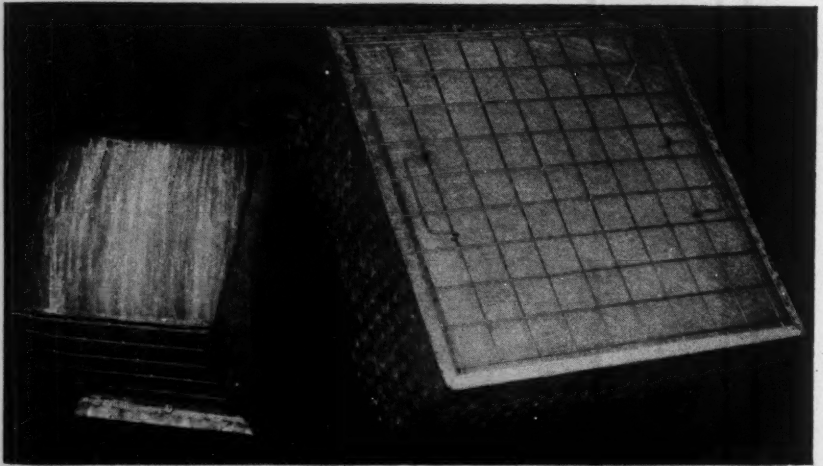
BELOW: The disassembled No. 200 Series RESEARCH FILTER showing filter pad and HOOKED wire grids.

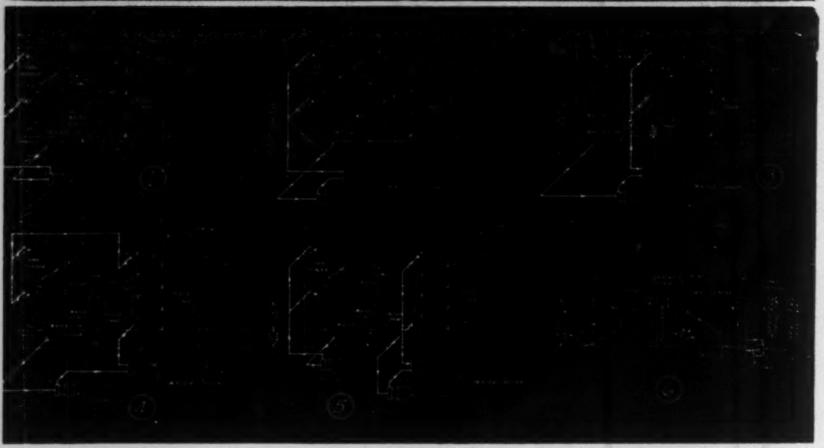


RESEARCH PRODUCTS CORP., MADISON, WIS.

CAPILLARY
AIR CONDITIONERS

Every Air Conditioning Engineer and all Industrial Engineers responsible for air conditioning should be familiar with the uses of this advanced equipment.





Glass strands parallel to the air stream as illustrated above offer highly efficient heat transfer and cleaning surfaces.

(1) As a simple air washer, humidifier or evaporative cooler capillary cells call for only 2½ gallons of water per 1000 cfm sprayed at 6 lbs nozzle pressure. Efficient spray washers require 15 to 20 gpm at 20 lbs pressure.

(2) A single stage of capillary cells is equivalent in cooling and dehumidifying capacity to a 2 bank spray type dehumidifier.

(3) Increased cleaning efficiency and an approach of less than 1° F between leaving water and leaving air may be obtained with the Class II Capillary, using counter-flow of air and water.

(4) Where 8 or 10 rows of cooling coils may be required in a simple coil system, a Class III capillary divides the load between 4 rows of coils and the capillary cells. Evaporative cooling is always available and the coils are kept clean.

(5) Where a closed system for the cooling medium is required, (direct expansion, brine or cold water) the capillary cells in advance keep the coils clean and evaporative cooling is always available to economize on refrigeration whenever entering wet bulb temperature allows.

(6) Capillary Conditioners of all types are made in standard sizes ranging from 2000 to 110,000 cfm for central station application. Assembled units including fans, heaters, coils, etc., suitable for suspension or floor mounting range from 3000 to 15,000 cfm.

Submit design and capacity conditions to receive specific recommendations or write for general information.

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268 McDonough Blvd.

CHARLOTTE, N. C.
P. O. Box 961

DETROIT
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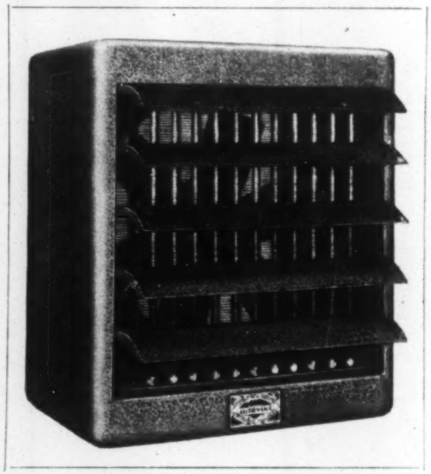
improvements incorporated in them is the new "Permanently Sealed" ball bearing which requires lubrication only once every three years, says the maker. Double row bearing width gives 50 per cent greater shaft contact area with consequent longer bearing life, and reduced shaft wear, it is stated.

New specially developed plastic wire coating gives maximum dielectric strength, toughness, and flexibility. Reinforced cuffs at slot edges protect windings from abrasion, and coil ends are taped to brace them against the strains of full voltage starting. A rigid one piece cast frame assures a stiff support for the rotor, and overall structural rigidity.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam Unit Heater

No. 2050—A redesigned line of steam unit heaters has been announced, ruggedness of construction being the principal feature, according to the maker.

The casing is new throughout. A two-tone Monel gray wrinkle finish adds a refinement that permits use in almost any type of installation. Each item of the assembly is die-formed. The vanes or deflectors are recessed for appearance and are individually adjustable.

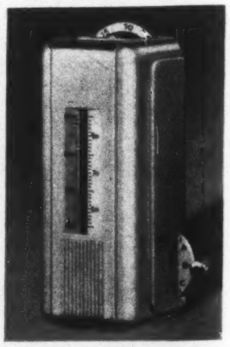


These units employ the "31 Series" non-overloading fan wheels. A special screw compression fitting is used between tube and header, thus eliminating any welded or brazed joints. The coils are tested at 500 lb hydrostatic pressure for any steam pressure from 2 to 150 lb. —Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill.

Room Thermostat

No. 2051—The new room thermostat illustrated is a twin contact control heater type thermostat with a sensitive bimetal element.

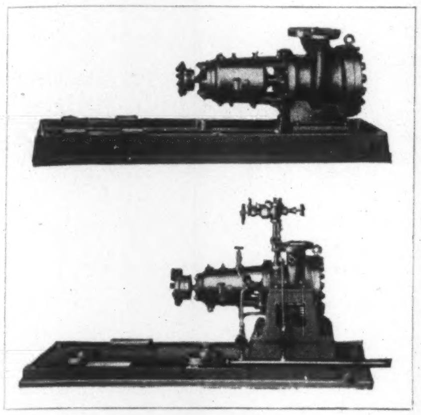
It incorporates two specific improvements, says the maker. First, the heater element is attached directly to the bimetal element so that the coil supplies heat to the bimetal by conduction, giving quick response and regular recycling. Second, the recycling characteristics can be adjusted by an external lever so as to "tune" the thermostat to the heating system, heating unit or type of fuel for economical and satisfactory operation.



These instruments are attractively styled and finished in light gold. — Perfex Corp., 500 W. Oklahoma Ave., Milwaukee, Wis.

General Service Pumps

No. 2052**—A new line of general service centrifugal pumps has been announced. These "Type SV" pumps are designed for all types of service and are able to meet a wide variation in pumping conditions, the maker states. They can be used both for ordinary general service application and for extremely high temperatures down to sub-zero temperatures, handling both heavy and light liquids. Capacities range from 25 to 1400 gpm against discharge pressures up to 300 lb. Pumps are designed for maximum casing working pressure of 600 lb and are suitable for handling liquids up to 750 F at speeds ranging up to 3600 rpm, it is said.

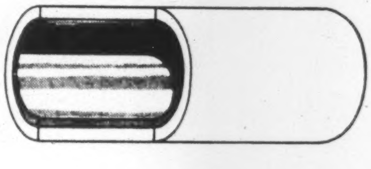


Pumps supplied for cold service are foot-mounted, as shown in the upper view, and those for hot service are centerline-mounted, as shown below. The pump for hot service is arranged with water cooled bearings, stuffing boxes and base pedestals, including provisions for removable lagging, if desired.—Pacific Pump Works, Huntington Park, Calif.

Duplex Tubing

No. 2053—An interesting recent development which has a number of possible applications in the piping and air conditioning fields is a duplex or bi-metal composite tubing. It was developed to meet a need in the oil refinery and process industries where heat exchanger tubes may fail rapidly from corrosion which attacks them from either inside or outside, the nature of the corrosion on the outside being different from that on the inside.

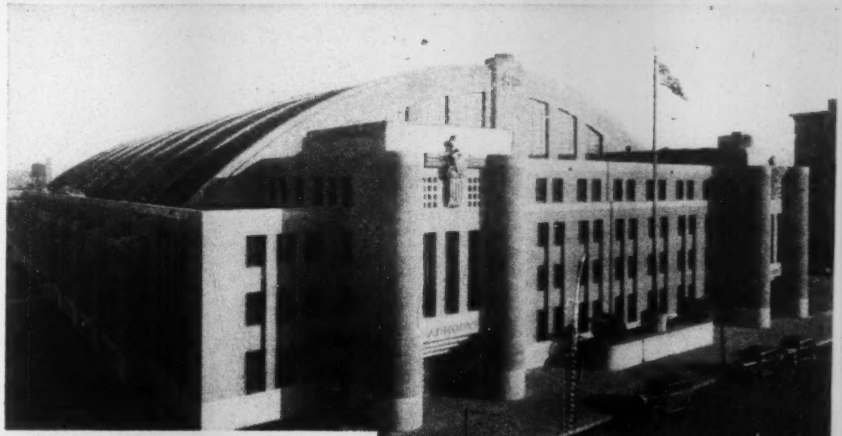
With the duplex tubing, this condition is treated as two corrosion problems. The best metal or alloy to resist the corrosive oil side is used, for example, and another metal or alloy is used to stand up against the corrosion of the circulating salt water.

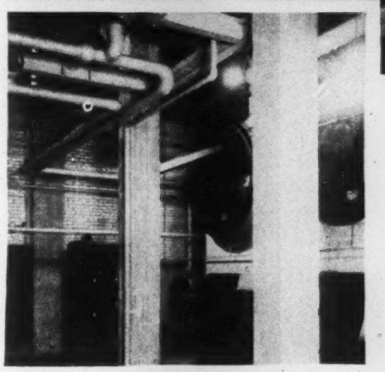


The sketch illustrates the construction of the duplex tubing; according to the manufacturer, a close contact is obtained between the two materials so as not to interfere seriously with heat transfer. Where the tubes have to be expanded or rolled into a tube sheet, they can be supplied with annealed or tempered ends suitable for this operation. A wide variety of combinations of metals or alloys can be had, but at the present time sizes are limited up to and including 2 in. outside diameter.

A possible application in refrigeration or air conditioning work might be the use of steel in contact with ammonia gas and copper on the circulating water side.—Bridgeport Brass Co., E. Main St., Bridgeport, Conn.

MATERIALS
MEN
METHODS... all three contribute to
INSULATION EFFICIENCY





Minneapolis Armory, Minneapolis, Minn. Boiler and Pipes insulated with Ruberoid 85% Magnesia Pipe Covering and Blocks. Architect and Engineer, P. C. Bettenburg. General Contractors, Peterson & Steenberg. Ruberoid Approved Insulation Applicator, Asbestos Products Corporation, St. Paul, Minn.

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A complete line of *insulation products*—for heating, cooling and air conditioning. *Hand-picked applicators,* the highest type in the industry. *Engineering counsel* whenever you wish it. Ruberoid offers you all three to safeguard insulation efficiency at all times.

Materials. The Ruberoid line of insulation includes pipe coverings and blocks for temperatures from 350° to 1600°F; Wool-felt pipe covering for hot or cold water conduits; asbestos papers for wrapping furnace pipes, protecting air conditioning ducts. All these, plus a group of specialties including high temperature cements, mill-board, roll board, mineral wool bats and blankets.

Men. Throughout the country Ruberoid has Approved Applicators — organizations known and respected for their knowledge of insulation and careful workmanship. These well-qualified, hand-picked applicators are of the highest type in the industry.

Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

On the next job specify Ruberoid Insulation Products. Get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for a copy of Ruberoid's latest Insulation Catalog. You will find it invaluable as a reference guide. Write The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Address Dept. HPC-2.

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THE AEROFUSE OUTLET GOES EFFICIENTLY ABOUT ITS BUSINESS

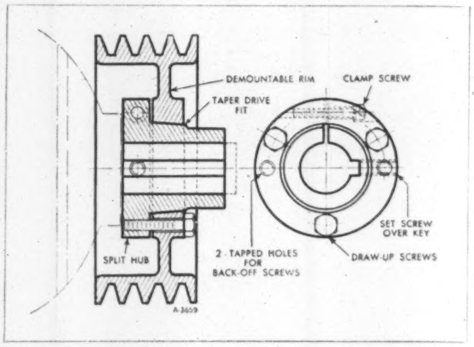
Notice the air of unobstrusive efficiency about this splendid modern office. It is quite natural that here you will find an installation of the Aerofuse Outlets. These ceiling — flush diffusers — unobstrusive and, because of the simplicity of its design, harmonizing well with any decorative plan, are noted, first, for their functional efficiency. Superbly they provide (1) Maximum Air Mixture, (2) Rapid Temperature Equalization, (3) Perfect Air Distribution, (4) Total Elimination of Drafts.

Write for informative booklet.

T & B TUTTLE & BAILEY, Inc.
NEW BRITAIN, CONN.
NEW YORK CHICAGO PHILADELPHIA

Quick Detachable Sheaves

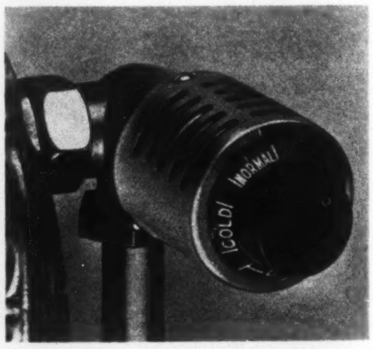
No. 2054*—A new type of v-belt driver sheave—designated as the "Q-D" quick detachable and quick demountable type—has been announced as a standard item in the manufacturer's multi-v drive line. It is particularly suitable for applications where quick mounting of sheave to the shaft and dismounting from the shaft are desirable—for instance, where speed ratios must be changed on fan, blower, and process machinery drives. In general maintenance, it eliminates necessity of a wheel puller to remove the wheel or hub from the shaft to get at the driving unit.



These sheaves are available in a complete range of standard driver sizes and are stocked at convenient points.—Worthington Pump & Machinery Corp., Harrison, N. J.

Radiator Control Valve

No. 2055—Redesigned for greater eye appeal and increased operating efficiency, the new "Model 120 Thermotrol" is suited for the individual control of radiators on all types of steam or hot water installations. Feature of these self-contained thermostatic radiator control valves, according to the manufacturer, is that of convenience and comfort. The unit measures 6 in. x 3 in. over-all, and is finished in satin nickel with black plastic fittings.



Fully self-contained, the device has a sensitive, built-in volatile type thermostat that opens and closes the valve to hold temperature at desired setting. The adjusting knob can be set for any point or desired maximum temperature up to 80 F. It can be locked at any desired temperature, and is also free to close completely by hand.—Sterling, Inc., 3738 N. Holton St., Milwaukee, Wis.

Unit Heaters

No. 2056—The line of "Beacon" unit heaters has been designed for better appearance. Instead of a square corner, box shaped casing, rounded corners are now used. The finish is an olive green crinkle enamel which is a neutral shade. This enables the owner to paint the units as desired.

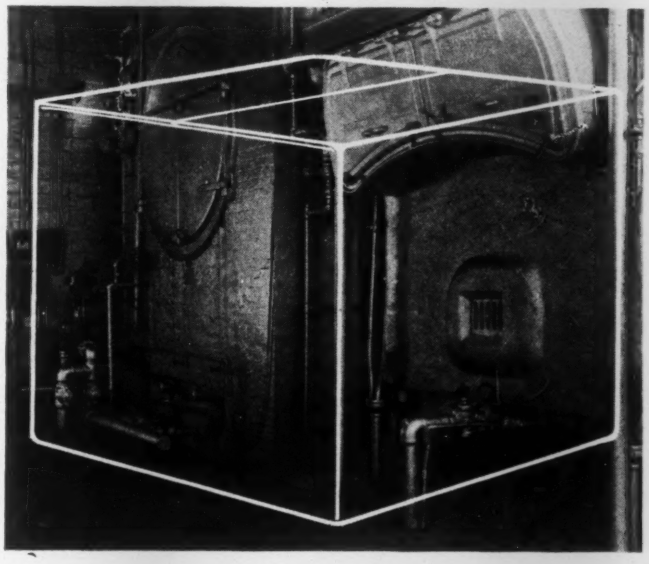
A wide blade aluminum fan, manufactured by Torring-

They have to be "RIGHT" to "REPEAT" like this...

Completely satisfied with a previous Webster Installation the Southwest Box Co. of Sand Springs, Okla., again selected a Webster Burner for their new boiler. A duplicate Series F600 installation has been made in their new plant at Fort Worth, Texas. Webster Series F600 Burners can be installed in any metal firebox or sectional boiler.

WECO—N.G.E. Series F600 Gas Burners are available for ratings from 50,000 to 10,000,000 B.t.u. output. Featuring: Multiple Port Interchangeable Grills, Improved Venturi, and Unique Baffles. Full automatic controls that operate properly can be easily installed.

Write for Bulletin



The F600W610 gas burner fires this boiler up to 150% of its rated capacity. Most recent installation made in right-hand boiler.

THE WEBSTER ENGINEERING CO.

TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. Toledo, Ohio

Tests that assure the dependable, trouble-free performance of CURTIS Condensing Units

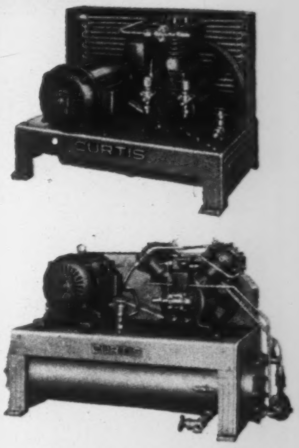
Selecting pins, using the Sheffield Visual Gauge.

Selective Piston Pin Fitting

Piston pins for CURTIS condensing units are checked for size, taper and out-of-round to .0001" by means of a Sheffield Visual Gauge and are matched with piston pin holes gauged and segregated according to the same tolerances. The Sheffield Visual Gauge measures to within ½ of one ten thousandths of an inch (.00005) and is set by Johansson Master Blocks.

Matching both pins and pistons according to such fine tolerances assures the closest, most accurate fitting. The result is less wear, less vibration, quieter operation and materially longer life.

This is only one of the many examples of the care and precision of Curtis manufacturing methods. All contribute to the long life, high efficiency and trouble-free performance of every Curtis Condensing Unit.

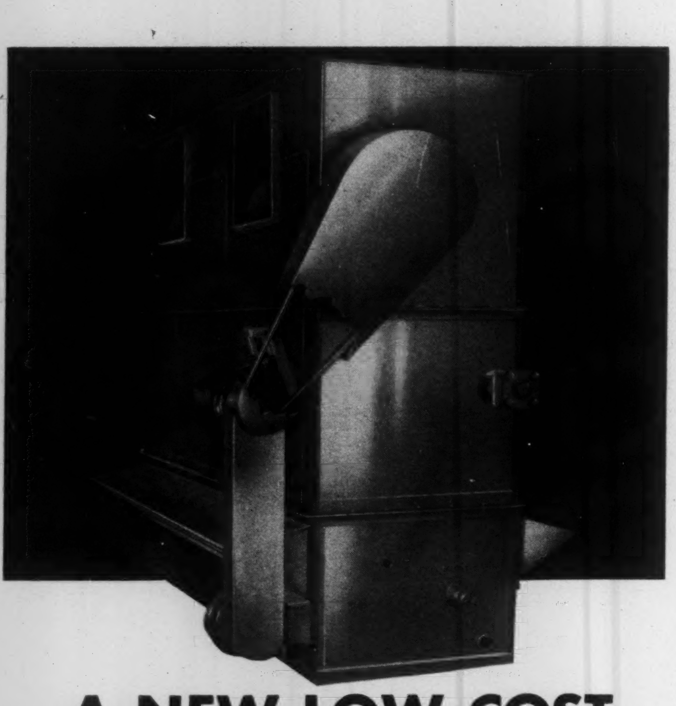


45 Air-Cooled Units — 42 Water-Cooled Units — 1/6 to 30 h. p.

Curtis Refrigerating Machine Company
1950 Kienlen Avenue, St. Louis, Missouri

CURTIS REFRIGERATION AIR CONDITIONING AND COMMERCIAL

Division of Curtis Manufacturing Company



A NEW LOW-COST

WATER SAVER

MAN! IT HAS A NEW EVAPORATING FEATURE THAT CUTS WATER CONSUMPTION FROM GALLONS TO OUNCES!

A BIG-TIMER . . . 7½ to 100 tons! Ingenious, utterly different designing reduces the new Peerless BWS Water Saver to complete simplicity, yet it *cools more refrigerant with less water than ever before possible.*

It's amazingly low in cost! It's built of nothing but the best! The *seam-welded* heavy steel casing is absolutely water-tight—the whole unit husky as a dock walloper. Water from *full cone* sprays is blasted against every inch of a V-shaped Thermek Condenser, instead of merely trickling through a deep bank of coils as in the conventional unit. *This new-type construction works every pound of water overtime*—accounts for the amazingly small amount required.

In all, twenty-five distinct star features. Among them, bronze and ball bearings . . . two-way adjustable belt drive, with separate motor-driven pumps available for larger jobs . . . balanced-impeller pump . . . special construction which makes all internal parts easily accessible. Models also available for Diesel engine water cooling.

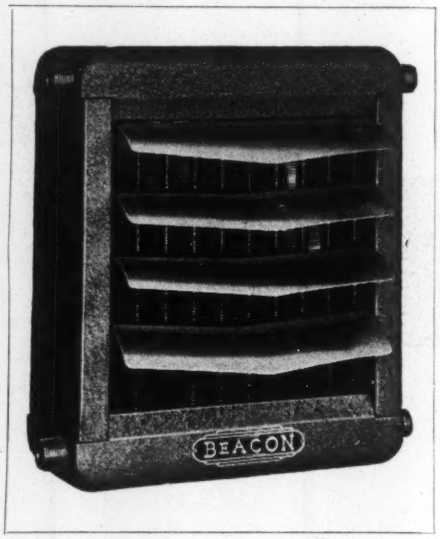
This is the unit which literally *builds economy* into air conditioning or refrigeration jobs.

WRITE TODAY FOR ENGINEERING DATA

Peerless OF AMERICA INC.

General Offices: 515 West 35th Street, Chicago, Illinois

Branch Offices: New York, Los Angeles, Dallas; Export Div., Detroit

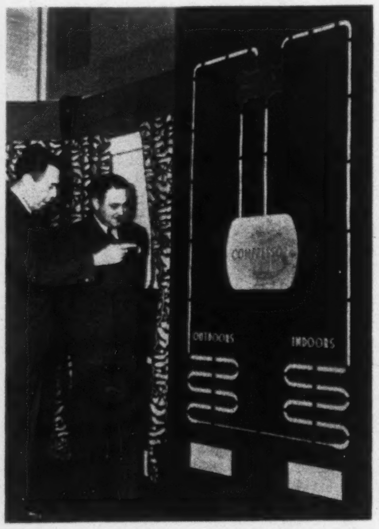


ton, is used. These fans are dynamically balanced to give maximum air delivery with minimum noise. Copper core construction is used, the tubes being expanded into the fins under hydraulic pressure to give a strong mechanical bond. Tubes and headers are of copper. The units are tested to 1000 lb hydrostatic pressure and guaranteed up to 150 lb steam working pressure.

These units come in a range of sizes from 76 to 1260 sq ft equivalent direct radiation.—Beacon-Morris Corp., 702 Beacon St., Boston, Mass.

Reverse Cycle Conditioner

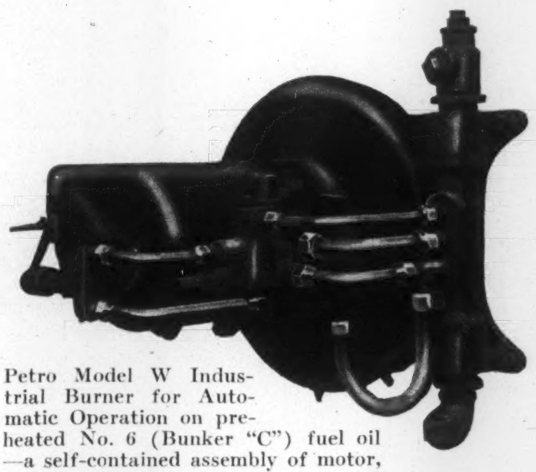
No. 2057—P. Y. Danley, manager of Westinghouse's air conditioning department, shows Frank R. Kohnstamm, merchandise sales manager, how the new plug-in air conditioner extracts heat from cold outside air and delivers it indoors, by merely turning a dial. Slightly larger than a table radio, the new "Mobilaire" room cooler fits any ordinary window and produces cooling or heating at the turn of a dial, the maker states.



Using reversed refrigeration for heating, the unit delivers several times more heat units per watt, than ordinary electric resistance heaters. The unit is converted into a heat pump by reversing the flow of refrigerant gas in the machine, causing the condenser and evaporator to trade functions.

This air conditioner has an hourly capacity of 6000 cooling units, and 7500 heating units and up, depending upon the outside temperature.—Westinghouse Electric & Mfg. Co., East Springfield, Mass.

For your convenience in obtaining more information about any of this equipment, see coupon on page 104. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed



Petro Model W Industrial Burner for Automatic Operation on preheated No. 6 (Bunker "C") fuel oil —a self-contained assembly of motor, fan, pump, rotary cup atomizer and interlocked air and oil adjustments.

PETRO INDUSTRIAL OIL BURNERS

Reg. U. S. Pat. Off.

Cut Steam Costs—*for reasons familiar to good heating men—such practical reasons as:*

1. Each Petro System is designed to meet and handle efficiently the operating necessities and characteristics of the plant it is to fire.

2. The units and accessories thus incorporated into each system are, in themselves, designed for maximum functional excellence, based on 38 years of oil burning experience.

3. Each such system maintains its specified firing performance and combustion efficiency at a fixed constant, even when the fuel is No. 6 oil—pre-heated—because the Petro Thermal-Viscosity System entirely eliminates frequent and manual compensating adjustments.

FOR AUTOMATIC — SEMI-AUTOMATIC — or MANUAL OPERATION

Capacities—to 145 gallons per hour—454 Boiler h.p.—68,000 Sq. Ft. Steam

Heating Engineers and Contractors know that, while completely automatic firing is the aim of cost-conscious management, because of its large labor-cost reduction, there are various operating circumstances which create sound reasons for using other firing methods. Consequently, there is Petro equipment for any of these necessary modifications, and for preheated fuel oils as well as for No. 5 (or lighter) oils.

Petro's complete engineering service is available to established contractors on oil burner installation problems. Layout and application data; suggestions; possible alternatives in specific problems; and drawings and specifications, if necessary, are part of this Trade service.

FOR FURTHER INFORMATION

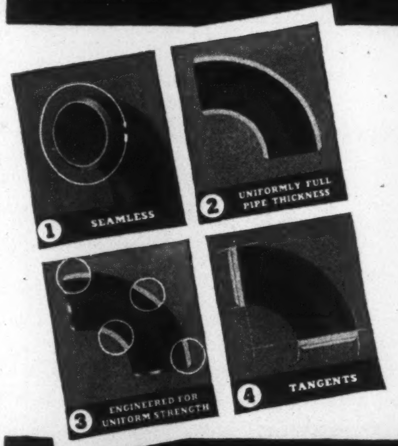
SEE OUR CATALOG IN SWEET'S

Petro's Engineering Division will gladly answer questions. . . . The Petro Industrial Equipment Catalog will be sent promptly on request.

PETROLEUM HEAT & POWER COMPANY

STAMFORD *--Makers of good Oil Burning Equipment since 1903--* **CONNECTICUT**

TAYLOR FORGE



1 SEAMLESS
2 UNIFORMLY FULL PIPE THICKNESS
3 ENGINEERED FOR UNIFORM STRENGTH
4 TANGENTS

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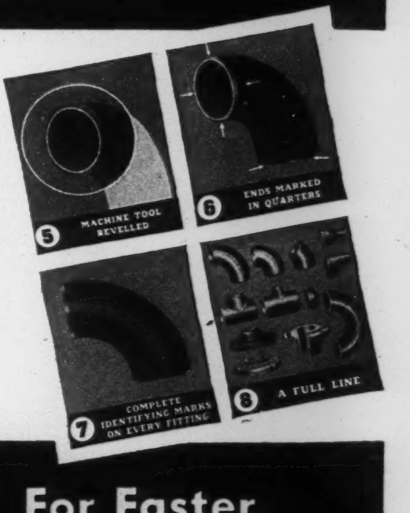
MAXIMUM ECONOMY

use WeldELLS, the fittings that offer you more features than any other welding fittings to speed welding and guard against trouble



5 MACHINE TOOL BEVELLED
6 ENDS MARKED IN QUARTERS
7 COMPLETE IDENTIFYING MARKS ON EVERY FITTING
8 A FULL LINE

Seamless Pipe Fittings **WeldELLS** **For Faster, Easier Welding**

TAYLOR FORGE & PIPE WORKS: General Offices and Works: Chicago, P.O. Box 485
New York Office: 50 Church St., Philadelphia Office: Broad Street Station Bldg.

"You can bank on FAIRBANKS"

You're Money Ahead with FAIRBANKS VALVES

There are good sound dollars and cents reasons why it will pay you to use Fairbanks Valves.

Only the best materials — the most expert workmanship — are used in building these valves. And they must pass the most rigid inspection before they leave our factory.

Consequently, they are easy to operate, seat perfectly, are easy to repack and close tightly at all times. Long life and low maintenance cost is assured.

Still further economies are effected if you use Fairbanks *Renewable* types, as worn seats and discs can be replaced in a few minutes, at a small fraction of the cost of a new valve, without removing the body from the pipe line.

They are made in bronze and iron, in types and sizes to meet almost every specific requirement.

Ask our distributor to show you the many outstanding features of Fairbanks Valves and write us for Catalog No. 21.

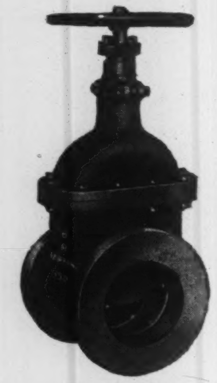


Fig. 0302

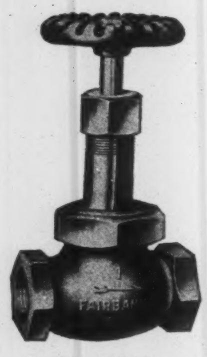


Fig. U-01

Fig. 0616

THE FAIRBANKS COMPANY

Valves, Dart Unions, Hand Trucks and Wheelbarrows

396 Lafayette St. New York, N. Y.

Boston, Mass., Pittsburgh, Pa.—Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks *Standard and* Renewable Valves

Useful Information

Pattern Development

Short Method of Pattern Development, a booklet just published by the American Rolling Mill Co., was prepared by Ralph W. Poe, sheet metal contractor of Canton, Ill., to explain in simple shop language an improved short cut to pattern drafting. Oldtimers may recognize the short method by other names—"rollation" or "roll-out" pattern making. For years it was an important trick of the trade passed on from father to son or from shop owner to apprentice.

Copies of this 48 p. booklet may be obtained from the Sheet Metal Shop Service Department, The American Rolling Mill Co., 703 Curtis St., Middletown, Ohio, for 30c in stamps or coin. (If you live in Ohio, enclose an extra penny or stamp to pay the Ohio State sales tax.)

ASTM Standards Index

The latest edition of the Index to ASTM Standards, Including Tentative Standards gives information on all of the 952 standards as of December 1, 1940. The index is of service to anyone wishing to ascertain whether the society has issued standard specifications, test methods, or definitions covering a particular engineering material or subject and it is of help in locating the standards in the volumes where they appear.

All items are listed in the index under appropriate key words according to the particular subjects they cover.

Copies of the 172 p. publication are furnished without charge on written request to ASTM Headquarters, 260 S. Broad St., Philadelphia, Pa.

Coal and Coke Standards

A recently issued booklet, ASTM Standards on Coal and Coke, combines in convenient form all of the ASTM tests, definitions, and specifications for coal and coke and meets the widespread demand for these standards used in connection with the evaluation of these materials. The volume is issued under the auspices of the American Society for Testing Materials' Committee D-5 on Coal and Coke. This group is actively engaged in further improvement of standards and in the development of additional tests covering other important problems.

Copies of this 135 p. publication may be obtained from the ASTM Headquarters, 260 S. Broad St., Philadelphia, Pa., at $1.25 per copy.

Foreign Digest

The Engineers' Digest is a new British monthly dealing exclusively with advances in applied engineering as abstracted from periodicals in foreign countries. Since it has become increasingly difficult to obtain periodicals from European countries, this periodical will be welcomed by those engineers who want information about new developments in other countries. Articles abstracted are particularly applicable to the work of the defense program of our country, it is announced.

Copies and subscriptions can be ordered from the Chemical Publishing Co., Inc., 148 Lafayette St., New York, N. Y.

Welding Fittings

In its standardization procedure the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., first issues a proposed standard as tentative in order that industry and all others concerned may have an opportunity to comment and submit criticisms before the standard is formally adopted. This is for the purpose of insuring that, when adopted, the standard will be entirely adequate and satisfactory.

The society has recently issued Tentative Specifications for Factory Made Wrought Carbon Steel and Carbon Molybdenum Steel Welding Fittings (ASTM A 234—40 T).

Book Reviews

Modern Air Conditioning, Heating and Ventilating

[Modern Air Conditioning, Heating and Ventilating, by Willis H. Carrier, Board Chairman, Realto E. Cherne, District Chief Engineer, and Walter A. Grant, District Chief Engineer, Carrier Corp. 1st ed. 1940. 538 + x pp., 6 x 9 in., clothbound, with psychrometric chart pasted in. Published by Pitman Publishing Corp., 2 W. 45th St., New York, N. Y. Price, $4.50]

Facts and formulas on every type of application problem in air conditioning, heating and ventilating are treated in this practical new handbook of engineering data. It provides for engineers, technical workers and all concerned with the three closely interrelated fields, much new and generally unavailable information. The authors show, step by step, how to design, how to apply, and how to use air conditioning, heating and ventilating. Over 450 photographs, charts, diagrams and tables illustrate the book. Featured is an up-to-date revision of the Carrier psychrometric chart

Information is presented on such subjects as air conditioning economics, estimating cooling and dehumidifying loads, refrigeration and piping specialties, methods of duct design, control systems, air distribution and zoning, forced hot water systems, design problems of specific applications, and estimating and design of sound absorbers and vibration eliminators.

District Heating Proceedings

[Official Proceedings, 31st Annual Meeting of the National District Heating Association. Vol. XXXI. 1940. 271 pp., 6 x 8¾ in., clothbound. Published by the National District Heating Association, 1231 Grant Bldg., Pittsburgh, Pa. Price, $5.00.]

The proceedings of the NDHA's 31st annual meeting, which was held at French Lick, Ind., May 14-17, 1940, are given in this volume. Included are listings of the officers and committees, complete membership list of the association, amendments to the constitution, annual meeting statistics, and other similar information.

Among the reports presented at the meeting and included in this book are the reports of the committees on education, membership, operating statistics, insurance rates, rates and regulation, meters and accessories, sales development, commercial relations, steam station engineering, distribution, chemistry, and research. Thus, the book is an up-to-date compilation of latest information and progress in the district heating field.

WHAT IN SAM HILL IS THIS ILG "ONE-NAME-PLATE" GUARANTEE?
UNIVERSAL BLOWERS
ILG
PROPELLER FAN
UNIT COOLERS
UNIT HEATERS

All-Ilg-Built MEANS

UNDIVIDED RESPONSIBILITY!

More than just a guarantee against defects in materials or workmanship, ILG's famous "ONE-NAME-PLATE" GUARANTEE is actually *assurance* of *dependability* in *operation!* Never just an "assembled" product, each ILG piece of equipment, *including the motor,* is engineered and made under *one* roof to *one* rigid set of standards—is tested, sold and guaranteed as a *complete unit.* Contractors and engineers have learned from experience that this balanced, coordinated engineering and manufacturing policy speeds installation, minimizes (practically eliminates) breakdowns, ends money-wasting repair and service calls—builds customer satisfaction. If you are not now deriving full benefits from installing ILG's long-life, trouble-free apparatus, call our nearest branch office or write today for catalogs and prices.

ILG

ILG ELECTRIC VENTILATING CO.
2841 N. CRAWFORD AVE., CHICAGO, ILLINOIS
Offices in 43 Principal Cities

Vitalized VENTILATION
AND AIR CONDITIONING
"AIR CHANGE...NOT JUST AIR MOVEMENT!"

YOU SHOULD KNOW ..IT HELPED BUILD OUR BUSINESS!

WE KILLED ALL DEAD SPOTS

Improved "Pull-Through" Design . .

The Outstanding Feature of the New Model 1941

MARLO UNIT COOLER

The full coil surface is evenly effective. No more dead spots—"Pull-Through" does it!

All aluminum construction—Cast End-Frames.

Full range of sizes.

Venturi Fan Ring—Quiet Operation.

Suitable for comfort cooling applications.

MARLO COIL COMPANY

6135 Manchester Avenue, St. Louis, Missouri

Refrigerating Equipment Manufacturers

Coming Events

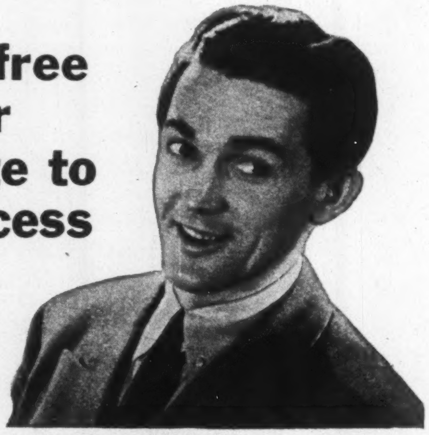
American Society for Testing Materials: Spring meeting, March 4-5, and committee week, March 3-7, The Mayflower, Washington, D. C. Headquarters office, 260 S. Broad St., Philadelphia, Pa.

National Oil Burner Progress Exhibition: March 17-22, Commercial Museum, Philadelphia, Pa. Official hotel headquarters, Hotel Benjamin Franklin. Sponsored by Oil Burner Institute, 30 Rockefeller Plaza, New York, N. Y. At engineering session to be held at Hotel Benjamin Franklin, Wednesday morning, W. O. Lum will speak on chimneys, R. K. Thulman on the commercial standard from the standpoint of FHA requirements, R. S. Dill on National Bureau of Standards heating equipment tests, and C. R. Welborn on Underwriters' Laboratories facilities and methods. Merchandising session will be held Thursday.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, June 3-5, Ambassador Hotel, Los Angeles, Calif. Headquarters office, 60 E. 42nd St., New York, N. Y.

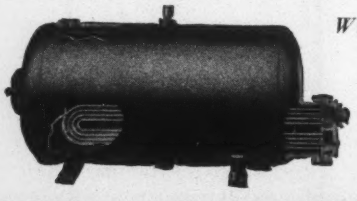
Smoke Prevention Association: Annual convention, June 3-6, Ansley Hotel, Atlanta, Ga. Secretary-treasurer, Frank A. Chambers, deputy smoke inspector, Department of Smoke Inspection and Abatement, City Hall, Chicago, Ill.

Let rust-free hot water contribute to your success



There is no better way to win and hold clients . . . no surer way to get clients to recommend you . . . than by specifying products which give satisfaction.

You can be absolutely certain that Patterson Everdur or Copper-Lined Hot Water Heaters will give entire satisfaction because they are guaranteed not to rust or cause red water—guaranteed to furnish all the hot water required, as hot as required and as quickly as required.

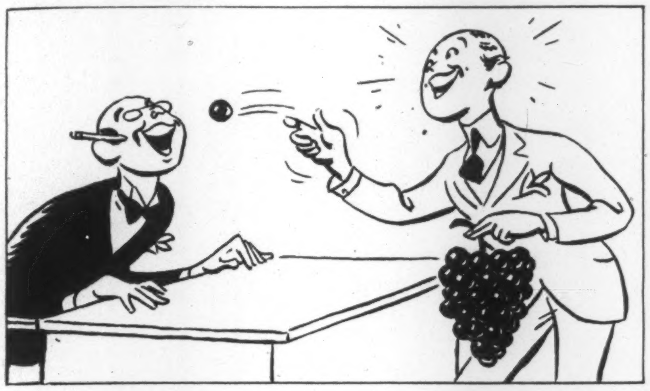


Write now for full particulars and catalog.

The Patterson-Kelley Co., Inc.
107 Warren St.
East Stroudsburg, Pa.

Patterson Hot Water Heaters

Air Filtering Facts—for forward-looking engineers



1. You're going to have the Treasurer eating out of your hand! Just wait 'till he gets a squint at the *low* low cost of Dust-Stop Air Filters in the air-conditioning system! They're about 1¢ per CFM to install complete, and only 1/10¢ per CFM to replace!

2. You don't hire a mechanic to open a pack of cigarettes . . . you don't have to hire one to change Dust-Stops! No skilled work required. What's more, they eliminate cleaning, charging, draining, etc. Nor do you have to keep any spares on hand.

3. People will say you're smart as a whip, when you specify Dust-Stops. They're *efficient*, stopping virtually all "nuisance" dusts. Capacity: 2 CFM per square inch of area at 300 FPM. Average resistance, new (in inches of water gauge): .065 for 1-inch; .125 for 2-inch Dust-Stops.

4. And the only kind of fire you might have to worry about is the kind above. Dust-Stop's glass-fiber filtering element and adhesive *will not support combustion!* The special patented adhesive, incidentally, is available only on Dust-Stop filters.

5. You can look and look and you won't find any adhesive droplets on your walls or inside your ducts. Dust-Stops just won't bleed! So—of course there's no problem there, either. But don't just read this advertisement and do nothing about it . . .

6. Order replaceable Dust-Stop Air Filters in a hurry! They come in two sizes, No. 1 (1-inch) and No. 2 (2-inch). Your air-conditioning manufacturer, jobber, or dealer has them. Or write: Owens-Corning Fiberglas Corporation, Toledo, Ohio.

FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U. S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

DIRECT CANADIAN INQUIRIES TO FIBERGLAS CANADA, LIMITED, OSHAWA, ONTARIO

DOUBLE PROTECTION
for air-conditioning ducts when they're lined with
J-M AIRACOUSTIC SHEETS

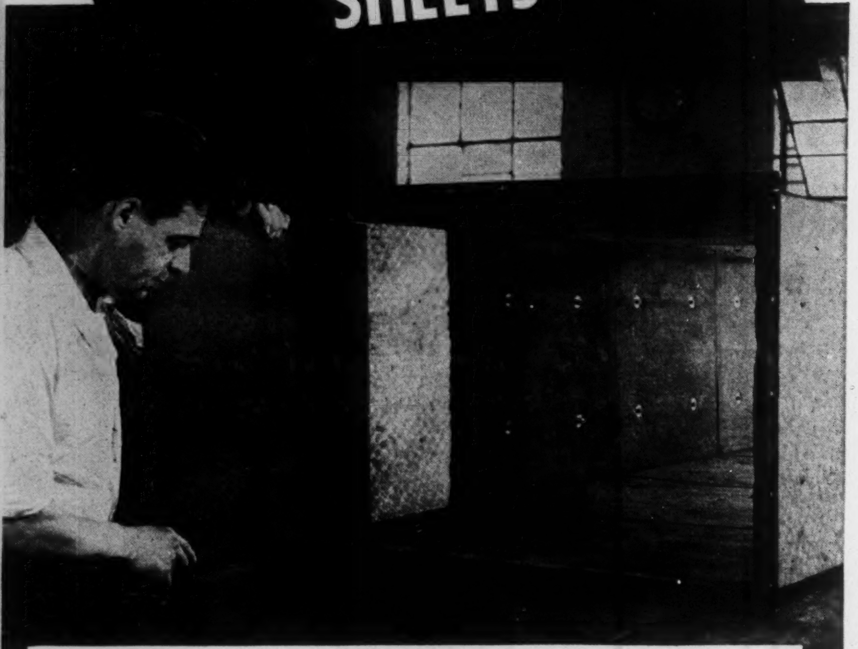
AGAINST NOISE : : . You'll be guarding against complaints about noise in your air-conditioning installations if you line ducts with J-M Airacoustic Sheets. This modern material soaks up 70% of all noise that strikes it. And its cost is so low that you can include duct quieting in every estimate.

AGAINST FIRE : : . Air-conditioning systems lined with J-M Airacoustic Sheets are safer. Because this modern material is basically mineral, it will not flame . . . introduces no fire hazard. Your clients will appreciate this extra protection.

• • •

YOU CAN USE J-M Airacoustic Sheets for lining any type of duct. They are light and easy to handle . . . simple and economical to apply. On the job, their unusual moisture resistance offers protection against humidity . . . keeps maintenance at a minimum. For details, write for brochure AC-23A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS Johns-Manville
AIRACOUSTIC SHEETS
FOR DUCT LININGS

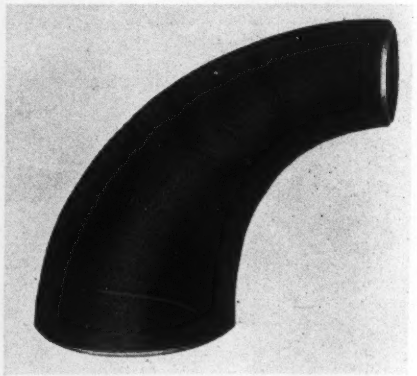


Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Reducing Butt Welding Elbow

No. 2058—A new reducing butt welding elbow has been added to the manufacturer's extensive line of welding fittings. In a pipe line where it is necessary to change both direction and pipe size, this new elbow will take the place of two welding fittings, a straight elbow and a straight reducer. The result, says the manufacturer, is a reduction in cost of welding fittings, elimination of one or two welds, saving in erection time and expense, and improved appearance.



These reducing elbows have the dimensional accuracy and uniformity of the maker's "American Standard" and "long tangent" elbows. After forming, welding and compression sizing operations, these elbows are stress relieved. Bursting pressure and other destructive tests have proved them stronger than pipe or tubing of corresponding size, it is stated.

Other new additions include a welding lateral and a welding tee reducing on the run with all dimensions interchangeable with those of a straight tee.—Midwest Piping & Supply Co., Inc., Second and Barry St., St. Louis, Mo.

Exhaust Head

No. 2059—The exhaust head illustrated insures the separation of condensate and oil from steam discharged to atmosphere and thereby prevents raining of water and

- - - - - - - - - - - - - - -

FOR YOUR CONVENIENCE

HEATING, PIPING AND AIR CONDITIONING, [3-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested):

2058	2059	2060	2061	2062	2063	2064	2065	2066	2067
2068	2069	2070	2071	2072	2073	2074	2075	2076	
3807	3808	3809	3810	3811	3812	3813	3814	3815	3816
3817	3818	3819	3820	3821	3822	3823	3824	3825	

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City ....State..............

HEAT

DEFENSE PLANTS · FACTORIES · WAREHOUSES · STORES

with

JANITROL

GAS-FIRED UNIT HEATERS

While it is true that Janitrol Gas-Fired Unit Heaters can be installed and in operation before the average central heating plant could pass the blueprint stage, this speed is only one of the many advantages of this modern heating method.

Great savings are recorded in large factories such as Libbey-Owens-Ford, Haughton Elevator Company and in large automobile factories. These savings are (1) Saving in heating plant investment and fuel storage and the room to house them; (2) Labor saved by elimination of heating plant operation; (3) Savings in heating plant maintenance and repair; (4) Saving of floor space (most Janitrol Unit Heaters are suspended from the ceiling).

The Heating Engineer and Contractor can render no finer service to defense industries than to show them how easily, quickly and economically Janitrol Unit Heaters will solve heating problems.

SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO

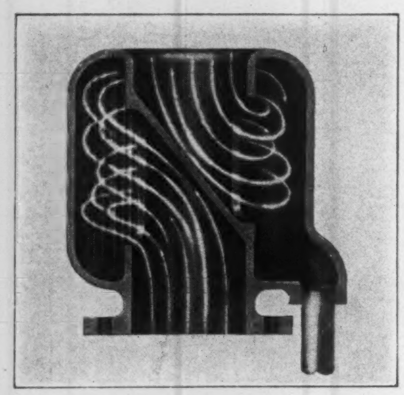
121 Janitrol Units Save 54% for Libby-Owens-Ford
Haughton Elevator Saves 53% Fuel Cost with Janitrol
91 Janitrol Units serve this Motor Car Maker

35 YEARS OF SPACE HEATING EXPERIENCE IS AVAILABLE TO ENGINEERS, CONTRACTORS AND OWNERS BY MAIL, PHONE OR WIRE

WINTER AIR CONDITIONERS
GRAVITY HEATERS
CONVERSION BURNERS
UNIT HEATERS

SC
35 YEARS

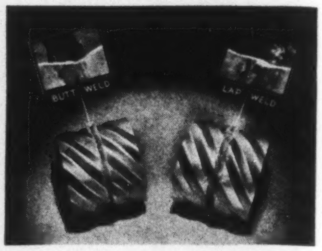
SURFACE COMBUSTION



oily condensate upon the roof or ground below, at the same time discharging clean, dry steam noiselessly, the maker states. It incorporates the principles of baffle type steam separators used for removing oil and moisture from steam lines. Exceptional port area produces low steam velocity and minimizes pressure loss, it is stated. Steam is whipped sidewise and causes projection of entrainment against ribbed baffle surfaces, the high ribbed baffles exerting a scrubbing action in addition to the centrifugal purging force.

The head is of one piece semi-steel construction for 4 to 12 in. sizes and of welded plate for larger sizes.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Steam Conduit With Welded Connection



No. 2060—An improved and exclusive method of connecting the units of an underground steam conduit system has just been announced. Referring to the illustration, at the left is a sample of butt welding and at the right is shown a lap weld. The helical corrugation in the "Armco Iron" conduit will match perfectly when rotated into position and this is easily done, according to the manufacturer.

For the lap joint ⅛ to ¼ in. lap of metal is obtained by springing the edge on one of the conduits. After welding the joint is protected against deterioration by a special heavy ¼ in. asphalt blanket applied with a plumber's torch. The asphalt is wrapped tightly with asbestos felt jacket to protect the asphalt coating. A joint with thin flanges welded to the conduit and welded at the outer edge can also be supplied.

These underground steam units are completely prefabricated and pre-sealed, and are delivered on the job in standard lengths including pipe, insulation and accessories. Standard pre-built fittings, such as elbows, tees and prefabricated expansion loops, can also be furnished as needed for each specific job.—Ric-wiL Co., 1563 Union Trust Bldg., Cleveland, Ohio.

Blower Fans

No. 2061—A new line of backward and forward curved blower fans for all heating, cooling and ventilating applications was announced last month. While the manufacturer's fans have been widely used for many years, they always have been incorporated in other products and, generally speaking, have not been offered separately.

The "Type FC" fan wheels are of the forward curved,

You Can Sell This Big, Growing Market
with CURTIS Packaged Air Conditioning Units!

- Restaurants
- Taverns
- Barber Shops
- Offices
- Beauty Shops
- Apparel Stores
- Shoe Stores
- Drug Stores

And that's only a partial list of the many, many examples of business establishments and retail stores providing the growing market for Curtis Packaged Air Conditioning.

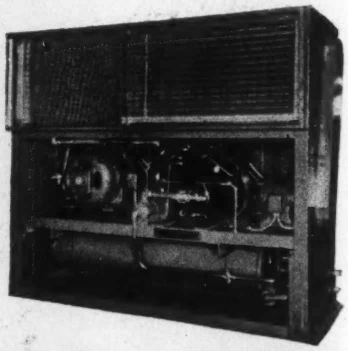
Curtis Air Conditioning units range from 3 to 15 tons in capacity. They are quickly and easily installed, attractive in appearance, easily financed, and engineered to give lasting satisfaction to the user.

The wide range of capacities offered by Curtis meets all requirements of this vast potential market interested in complete mechanically refrigerated, low cost air conditioning. Competition is forcing merchants everywhere to install air conditioning to hold their trade.

Here is your opportunity to make greater sales and profits this year. Write for complete information on the complete Curtis line today.

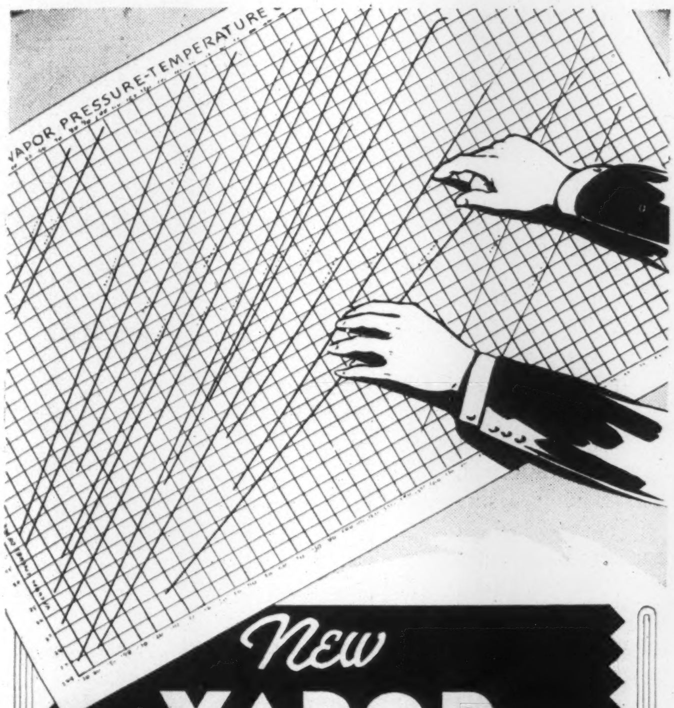
Curtis Refrigerating Machine Company
Division of Curtis Manufacturing Co.
1950 Kienlen Ave. St. Louis, Mo.
Established 1854

CURTIS
REFRIGERATION
AIR CONDITIONING
AND COMMERCIAL



(Above) 3 *and* 5 *ton Packaged Type Air Conditioner.*

(At Right) 7½, 10, *and* 15 *ton Central Type Air Conditioner.*



New VAPOR PRESSURE temperature CHART

20" x 30" Suitable for Mounting, Covering 35 Thermostatic Filling Liquids . . . . .

We have just published our engineering department chart, recording the relation between vapor pressure and temperature of a large number of thermostatic filling liquids.

The compilation of this chart required practically an entire year of intensive work on the part of our laboratories, and the information will, we believe, be invaluable to laboratories or engineering organizations requiring such data.

A limited quantity of these charts is available for those seriously interested. Address your request to

CLIFFORD MANUFACTURING COMPANY
Producers of
HYDRON METALLIC BELLOWS
564 East First Street, Boston
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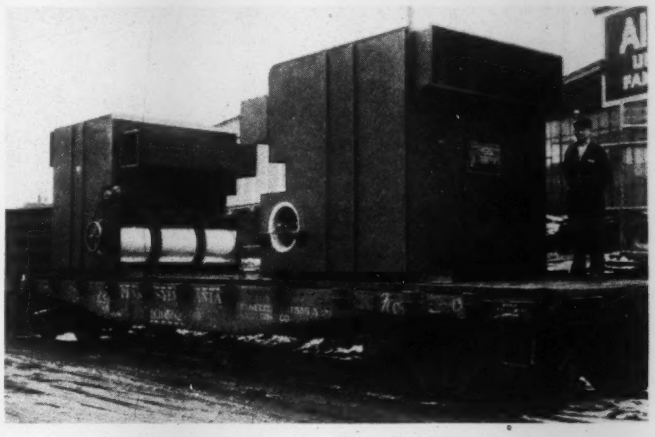
AIRTHERM

Scores Again!

HERE ARE 3,000,000 BTU'S FOR A LEADING MIDWEST STEEL PLATE FABRICATOR



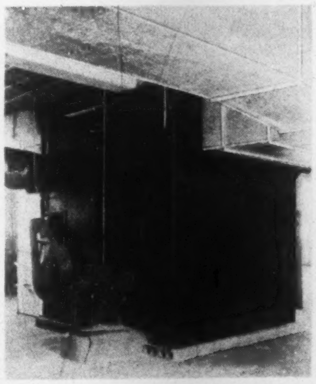
- Two Directherm Directfired Unit Heaters of 1,500,000 BTU capacity each are loaded on a flat car and ready to move out to a thoroughly pleased customer

THE SWING IS TO DIRECTHERM DIRECTFIRED UNIT HEATERS

- **Because** Directherm units have proved their ability to stand up and deliver efficiently, economically and for a long period of time.
- **4 Years of Uninterrupted Service** is the enthusiastic report from one typical Directherm user. During that time he has enjoyed low heating cost with high heating efficiency as the result of the wide and uniform heat distribution obtainable with these units.

OIL, GAS OR COAL

- Directherm Directfired Heaters are low in first cost and are economical to operate both as to fuel consumption for heat produced and as to maintenance cost. They can be easily hooked up for outside air intake and filters may be used in the intake box when desired. Where separated areas are to be heated, duct work can be efficiently used because the fan equipment is of ample capacity to overcome duct resistances.
- These units are available in 6 standard sizes ranging from 300,000 to 1,500,000 BTU capacities and are made up of heavy steel plates, sheets and sections with all-welded construction throughout. The flue gas header is readily cleanable assuring high combustion efficiency at all times. Write for Bulletin 305A containing complete information.



The Directherm Heater to the left shows a typical duct installation . . . the unit serving two floors. Note side mounting of oil burner in this case.

AIRTHERM
MANUFACTURING COMPANY
712 S. SPRING AVE. ST. LOUIS, MO.

What's YOUR most important need in INSULATION?

REFRIGERATING and air-conditioning systems operate at high efficiency when J-M Rock Cork Sheets and Pipe Insulation are used.

PERMANENT EFFICIENCY? Rock Cork is the answer! For more than a quarter-century, this basically mineral, unusually moisture-resistant insulation has been demonstrating its ability to withstand the severe punishment of low-temperature service. Hundreds of installations made years ago are still in excellent shape . . . promise many more years of dependable, economical service.

ECONOMICAL INSTALLATION? Rock Cork is the answer! Light in weight, easy to handle . . . it can be quickly and easily applied. And on the job its durable structure and essentially mineral composition provide complete freedom from rot . . . keep maintenance low.

LOW COST? Rock Cork is the answer! Today you get all the advantages of this basically mineral insulation at a price that compares favorably with other materials. And because the physical properties of Rock Cork are under rigid control at all stages of manufacture, you're sure of complete uniformity.

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For full details, write for brochure DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

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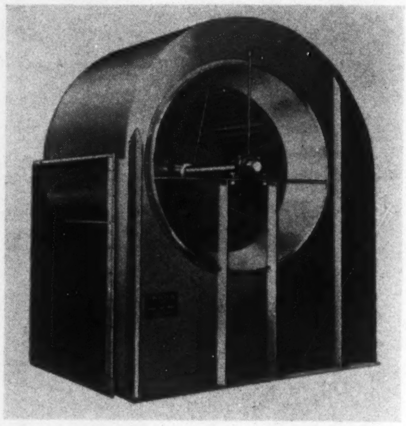
ROCK CORK
Sheets and Pipe Covering

multiblade type, and have been developed to conserve space, lessen power requirements, eliminate noise, and yet deliver full capacity at the lowest possible speed, it is stated. The "BI" wheels have 12 backwardly inclined blades with a special, accurately formed rim. Also included in the line are direct connected units for general utility duty, supply and exhaust. Both "FC" and "BI" fans are available in this construction which consists of integral motor brackets, fan housing, single width wheel mounted directly on motor shaft. The housings are convertible for various standard directions of discharge. Capacities range from 295 to 4500 cfm.



All of the parts which go into the complete fan assembly—back plate and hub, pillow blocks, bearings, housing—are precisely constructed for efficient performance together, the maker states.

The "FC" fans are available in single and double widths, in sizes ranging from 4½ in. wheel diameter to 60 in. The "BI" fans range from 15 to 66 in.—Trane Co., LaCrosse, Wis.

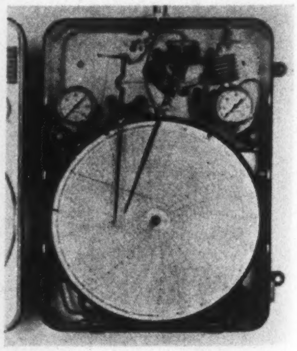
Open End V Belting

No. 2062—A new line of open end v belting for application on drives where endless v belts cannot be applied or can be put on only at considerable expense and trouble in tearing a machine apart to get at the sheaves has been announced. Made in maximum 50 ft lengths, it is available in top widths of 21/32, ⅞ and 1¼ in. and in thicknesses of 7/16, ⅝ and ¾ in. Angle in each case is 40 deg. Metal fasteners are used.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Pre-set Free Vane Controller

No. 2063—The addition of a new throttling type air operated temperature controller to a line of free vane automatic control instruments has been announced. Known as a pre-set free vane temperature controller, it was developed for use on processes where the thermal characteristics are such that there is a tendency for the temperature to exceed the control setting of the instrument on the initial rise.

Many processes, particularly batch processes that are started up and shut down at frequent intervals, have heating characteristics which cause overshooting of the control point on the starting up cycle. This is due primarily to slow rate of circulation and resistance to heat



ELIMINATE THESE HANDICAPS WITH KATHABAR

AIR CONDITIONING

~~OVER-COOLING~~
~~RE-HEATING~~
~~BY-PASSING~~

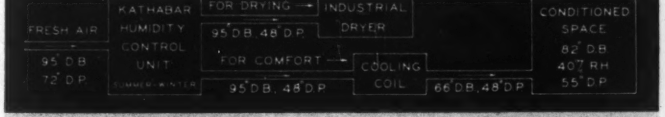
● Kathabar's unique humidity control principle liberates the engineer and architect from traditional handicaps of over-cooling, re-heating, by-passing. Designers of today's ultra-modern Defense Program industrial plants are turning to Kathabar to provide an air conditioning system as advanced as the factory buildings.

It is significant that Kathabar units are being incorporated into the air conditioning systems being installed in the latest factory buildings now under construction.

You can advantageously use Kathabar Pre-created Humidity with any system or method for conditioning air. Space requirements are greatly reduced, control simplified, operating cost sharply cut. Learn about Kathabar . . . Write for technical data.

SURFACE COMBUSTION CORPORATION, TOLEDO, OHIO

KATHABAR STRAIGHT-LINE PRINCIPLE



● **Kathabar creates the desired humidity without changing temperature at the beginning—*as the outside air enters the building*. All that is necessary thereafter is to cool or heat the air to desired temperature. No over-cooling, re-heating or by-passing. With Kathabar humidity is handled entirely independent of temperature, with ease, precision and economy. Kathabar employs no toxic, explosive, or dangerous gases or liquids.**

- **FOR COMFORT**—in hotels, restaurants, public buildings, office buildings, factories, stores, theatres and recreation places.
- **FOR HEALTH**—in hospitals and institutions.
- **FOR CONTROLLED DRYING**—where materials and their by-products must be dried under controlled conditions.
- **FOR SPECIAL ATMOSPHERES**—in industries where air conditions affect materials, processes and products.
- **FOR DRY BLAST**—in cupola and blast furnaces where conditioned air is required in combustion.

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EQUIPMENT FOR NATIONAL DEFENSE

FOR 34 YEARS
THE LARGEST MANUFACTURERS OF GAS-FIRED EQUIPMENT EXCLUSIVELY

SURFACE SC COMBUSTION

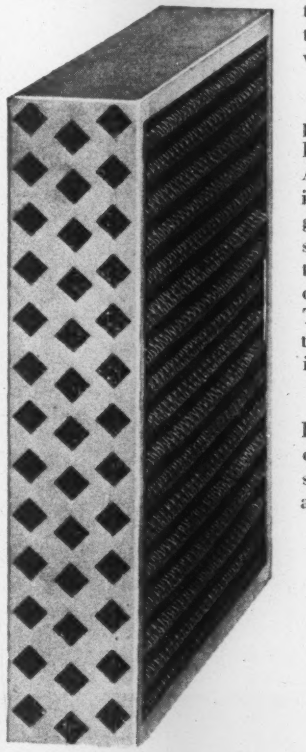
ALSO MANUFACTURERS OF JANITROL GAS-FIRED DOMESTIC AND COMMERCIAL HEATING EQUIPMENT AND SC INDUSTRIAL FURNACES

WHAT'S YOUR AIR FILTRATION PROBLEM?

Put it up to AIR-MAZE Engineers to Solve it for You!

● When it comes to air filtration problems—whether it's the removal of dust, grit, grease, ink, paint, oil, moisture or other substances—there are but few that cannot be solved satisfactorily and economically with *standard* AIR-MAZE filter panels.

While all the various AIR-MAZE panels all have in general the same unique all-metal filter element—which embodies the swirling baffle-impingement principle, and which incorporates the exactly graduated progressive density feature—they are each specifically adapted to the special type of service they are required to perform. And experience shows that they do the jobs for which they are intended exceedingly well.



Occasionally however, a tricky problem arises which cannot be licked by the use of any of the AIR-MAZE *standard* panels. This is where AIR-MAZE engineers go into action. We have quite a staff of them with many years of training and experience in the complexities of air filtration. These men like nothing better than a chance to sink their teeth into a tough problem.

Maybe they can help *you*. At least it will cost you nothing to consult with them and they may save you a lot of trouble, time and money.

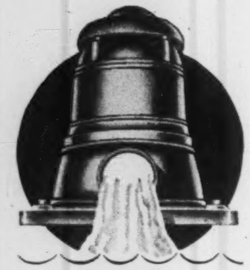
Write us today, stating your problem. We'll make a study and recommendation without obligation to you.

AIR-MAZE CORPORATION
5200 HARVARD AVE. CLEVELAND, OHIO

AIR-MAZE
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

The Man

WITH THE TRANSIT



First on the scene of any building project is the man with the transit . . . a symbol of progress. And next is usually Layne Engineers, Drillers and Hydrologists, for water supply must precede construction. Layne Well Water Supply Systems serve almost every type of industry, including cities and towns throughout the entire world.

Basically Layne Wells and Pumps are finer. Into their designing has gone features that are exclusive; patented and not duplicated elsewhere. The materials are tougher, stronger, smoother operating and most efficient.

AFFILIATED COMPANIES

Layne-Arkansas Co. Stuttgart, Ark.
Layne-Atlantic Co. . . . Norfolk, Va.
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Layne-Louisiana Co. Lake Charles, La.
Layne-New York Co. . New York City and Pittsburgh . . . . . . Pa.
Layne-Northwest Co. Milwaukee, Wis.
Layne-Ohio Co. . . . Columbus, Ohio
Layne-Texas Co. . . . Houston and Dallas . . . . Texas
Layne-Western Co., Kansas City, Mo. Chicago, Ill. . . . Omaha, Nebraska
Layne-Western Co. of Minnesota Minneapolis . . . . Minn.
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International Water Supply, Ltd., London . . . . . . Ontario, Canada

If your water supply is inadequate, or if it is costing too much, Layne Engineers will gladly cooperate on plans for a newer, more modern and better water supply. For new literature showing and explaining the many Layne features, address—

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PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

transfer. An example of this type of process is the jacketed cooling unit where the jacket has appreciable mass and requires considerable cooling medium to arrive at the desired temperature.

On processes of this type the pre-set controller introduces a pre-setting effect that is proportional to the width of throttling range and also rate of change of the condition being measured and controlled, the maker states. The controller action occurs prior to or during the approach of the pen to the control point. It tends to decrease the rate of change of position of the pen and permits the controlled temperature gradually to approach the control point.

The magnitude and duration of the pre-setting effect may be adjusted over a wide range by a convenient adjustment of a pointer on an arbitrarily calibrated dial.—The Bristol Co., Waterbury, Conn.

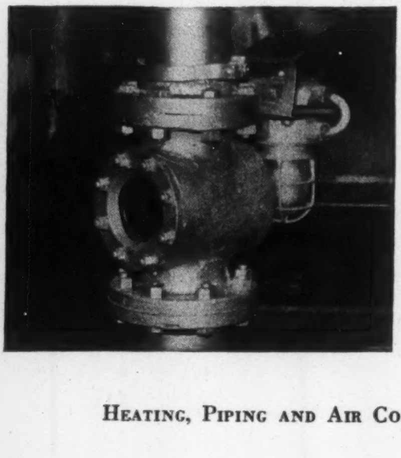
Totally Enclosed Fan Cooled Motors

No. 2064—A new line of totally enclosed fan cooled motors has been improved both in appearance and internal design, according to the manufacturer. They have a smoother, more symmetrical surface and are finished in a smooth machine gray to blend with other manufacturers' equipment.

They provide necessary protection where the air is foggy with metal cutting solutions, or where there are abnormal quantities of metallic, abrasive and other dusts in the atmosphere that would ordinarily injure or clog the windings of a general purpose open motor. A generous quantity of cooling air is forced through the large air passages by the non-sparking fan, causing a cooler motor with cleaner air passages.

The air intake passages are not easily clogged and so designed that a 5/16 in. rod will not pass through them, it is stated.—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Sight Glasses For Pipe Lines



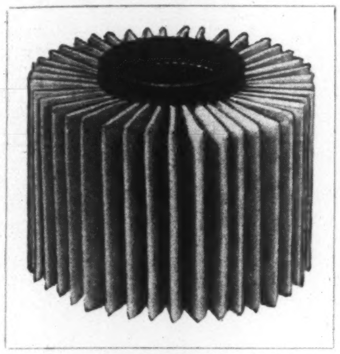
No. 2065—Sight glass fittings announced last year have been supplemented by five smaller sizes with screwed connections. Sizes range from ¾ in. to 2 in. for the new screwed connection fittings and from 2½ in. to 8 in. for the flanged design.

Bodies are of cast iron for pressures to

125 lb per sq in. "Pyrex" windows are held in place by gasketed steel frames. Weights have been reduced on all sizes.—Cochrane Corp., 3161 N. 17th St., Philadelphia, Pa.

Water Filter

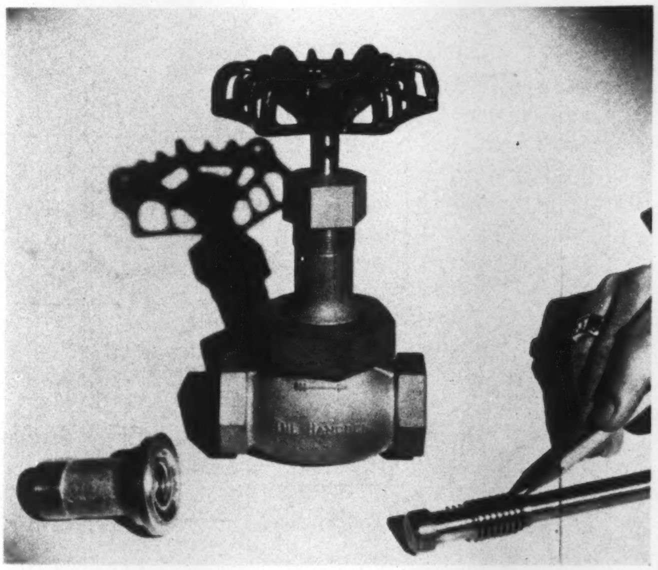
No. 2066—The "Radial Fin Construction," used in more than half a million filters for air transmission lines and internal combustion engines, has now been adapted in a new model to the filtration of water. The new filter has already proved its value under actual working conditions in paper mills, hydraulic and humidifying apparatus, chemical plants, shirt factories, rolling mills and to many other less well-classified users, the maker states. Construction is simple and permits a large area of filtering medium to occupy a relatively small space. For example, an insert only 11 in. high by 8¼ in. in diameter possesses an active filtering area of 1325 sq in. There are no moving parts.



The illustration shows a cross-section of the radial fin construction insert.—Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.

Longer Wearing Valve Stems

No. 2067—A new, longer wearing alloy, "Hancodur," for valve stems and bonnets was announced last month. This self-lubricating alloy was developed expressly for use in "Superfinished 500 Brinell" bronze valves.



It is stated that the new stems have a tensile strength of 90,000 lb plus a high self-lubricating characteristic that resists galling and wear. The makers say that due to increased production and lower manufacturing costs their full line of "Superfinished 500 Brinell" bronze valves are now furnished with the new stems and bonnets.—Hancock Valve Div., Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport, Conn.

MATERIALS
MEN
METHODS...all three contribute to
INSULATION EFFICIENCY

Philadelphia Vocational School, Philadelphia, Penna. Boiler and pipes insulated with Ruberoid 85% Magnesia Pipe Covering and Blocks. Cold water lines insulated with Twin-Purpose Woolfelt. Architect, Irwin T. Catherine. General Contractor, Matthew McCloskey & Co. Heating Contractor, Riggs-Distler Company. Plumbing Contractor, William H. Walters & Sons, Philadelphia, Penna.

RU-BER-OID
SUPPLIES
ALL THREE!

Real insulation efficiency for heating, cooling and air-conditioning is determined by three factors. Proper products to meet each specific problem. Hand picked men skilled in insulation application. Sound engineering counsel to accomplish maximum results at minimum cost. Ruberoid offers you all three to safeguard insulation efficiency at all times.

Materials. The Ruberoid line of insulation is complete. It includes pipe coverings and blocks for temperatures from 350° to 1600°F; Woolfelt pipe covering for hot or cold water conduits; asbestos papers for wrapping furnace pipes, protecting air conditioning; specialties such as high temperature cements, millboard, roll board, rock wool bats and blankets.

Men. Throughout the country Ruberoid has Approved Applicators — organizations known and respected for their knowledge of insulation and careful workmanship. These well-qualified, hand-picked applicators are of the highest type in the industry.

Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

Get All Three. On the next job get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for Ruberoid's latest Insulation Catalog. Invaluable as a reference guide. Address The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Dept. HPC-3.

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REMOVE OIL and MOISTURE from STEAM and AIR with COCHRANE SEPARATORS & PURIFIERS

Keep the Steam You Use CLEAN and DRY Keep Compressed Air PURE

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For Horizontal Pipe Lines
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For Exhaust Steam Live Steam • Compressed Air

The most popular all-service separator on the market. Thousands in use. Adapted to restricted locations.

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Highly efficient • One-piece Construction • Self-Cleaning • Low in Cost

LOW-PRESSURE SEPARATOR

For Pressures up to 75 lbs.

For Exhaust Steam • Low-Pressure Live Steam

Exceptionally Large Port Area Self-Cleaning • Welded Construction

RECEIVER SEPARATOR

Wherever large quantities of water are to be expected.

Receiver takes care of extra large flushes of water due to condensation, priming or foaming.

STEAM PURIFIER

The danger and inefficiency of wet dirty steam and slugs of water are eliminated with the installation of a Cochrane Purifier. Boilers have often been doubled in capacity by this simple method delivering dry pure steam at higher pressures.

Descriptive Bulletins with tables of sizes and capacities will be mailed on request. Write today stating type of equipment you are interested in, or nature of purification problem.

COCHRANE CORPORATION • 3131 N. 17th STREET, PHILADELPHIA, PA.

COCHRANE

WATER SOFTENERS • STEAM SPECIALTIES • DEAERATORS • FLOW METERS

Cleaning Compounds

No. 2068**—Two new products, "Flush" and "F.O.S." have been made available to the heating trade, it was announced last month by a company which handles maintenance of heating plants for many large buildings and real estate management companies in New York.

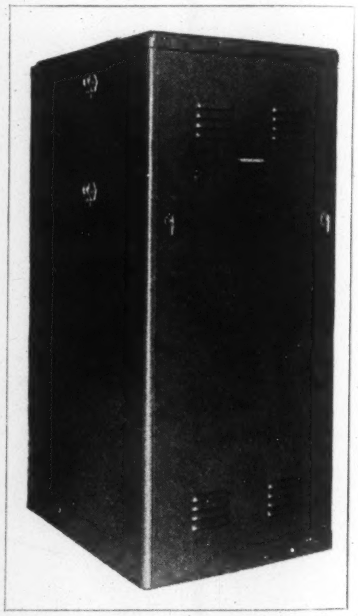
The first product is a liquid boiler cleaning compound designed to remove slime, mud, scale and rust from the water sides of low pressure cast iron or steel steam boilers. This product is also available in powder form.

The second product is a liquid chemical compound which when added to fuel oil in small proportions removes sludge from oil tanks and carbon from the burners or preheaters, according to the maker.

The objectives of both of these products are to reduce fuel waste and permit maximum heating efficiency.—Diamond Chemical Products, 12 E. 41st St., New York, N. Y.

Gas Fired Units

No. 2069**—"Gas-Vac" winter air conditioning units with inputs of 50,000, 81,000 and 110,000 Btu, and designed to operate on any type of gas, have been announced. They are equipped with fans, filters, humidifiers, safety pilots, thermostats, limit and fan controls, and vacuum safety valves.



Feature of this equipment is that it does not depend on the conventional chimney for draft, the maker says. Combustion is supported by a small vacuum exhauster which maintains a partial vacuum on the unit, drawing air for combustion, into the burners, premixed with the gas. A flame temperature of well over 2000 F is obtained; the products of combustion are cooled to the point of condensation, and flue temperatures run as low as 160 F, it is stated.

Inasmuch as combustion is supported by vacuum instead of chimney draft, there are no down draft problems, the maker states.—Vacuum Gas Appliances Div., Union Fork and Hoe Co., Rome, N. Y.

Packing

No. 2070—Two new types of packing, one made of "Ameripol," a synthetic rubber developed after 14 years of research and revealed last summer, and the other "Koroseal," a synthetic elastic material, have been announced. Both are sheet packing.

The "Ameripol" product is a dark sheet packing superior in its resistance to the action of oils, according to the maker. It is made to order only in 100 lb rolls, ap-

JUST A FEW MINUTES NOW AND YOU'LL BE AS GOOD AS NEW

About 99% of valve wear comes on the seat rings or discs. When they're worn, the rest of the valve is usually as good as new.

Then doesn't it strike you as absurd and wasteful to throw away an *entire* valve merely because a small, inexpensive part is worn out?

Fairbanks RENEWABLE Valves eliminate this big waste. If a leak develops, you simply remove the worn seat ring or disc and slip in a new one. The whole operation takes only a jiffy. You don't even have to remove the valve from the pipe line or disturb the covering.

And the cost is only *cents* compared with *dollars* for a whole new valve. In addition, this saves the time, trouble and expense of removing non-renewable types from the pipe line and does away with costly shut-downs.

Why not stop this deplorable waste now by replacing your worn valves with Fairbanks "Renewables!"

Write for catalog No. 21 and name of our nearest distributor.

Fig. 0302
150 lbs. steam pressure

THE FAIRBANKS CO.
396 Lafayette St., New York, N. Y.
Valves, Dart Unions, Hand Trucks and Wheelbarrows
Boston, Mass., Pittsburgh, Pa.—Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks Renewable Valves

INDEPENDENT "Fabrikated" REG. U.S. PAT. OFF. *Adjustable*

DIRECTED AIR FLOW REGISTERS and GRILLES

LEAD in Adjustability

An unlimited range of deflections is made possible by the ability to adjust the grille bars INDIVIDUALLY. Air flows can be directed up or down, or right or left. The directional adjustment can be made at the time of installing; and after the system is operating, corrections can be made at any time to meet unforeseen or changed conditions.

TWO NEW CATALOGS READY FOR YOU

Independent's two new catalogs just off the press are most complete, with interesting data on registers and grilles for air conditioning installations, and registers and cold air faces for gravity installations. Most conveniently arranged, everything easy to find. Send for your free copies.

THE INDEPENDENT REGISTER CO.
3747 E. 93rd ST., CLEVELAND, OHIO

A41

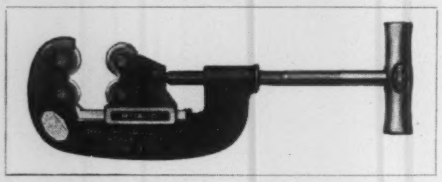
EVERY Grille Bar Can Be INDIVIDUALLY Adjusted

proximately 36 in. wide in thicknesses from $\frac{1}{32}$ to $\frac{1}{4}$ in.

The "Koroseal" packing is specially compounded to resist the action of oils and solvents, and also resists the action of some corrosives.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Pipe Cutter for Close Quarters

No. 2071—A new "Ridgid" pipe tool has recently been announced—a special handle, four-wheel cutter for work in close quarters and for increased cutting speed.

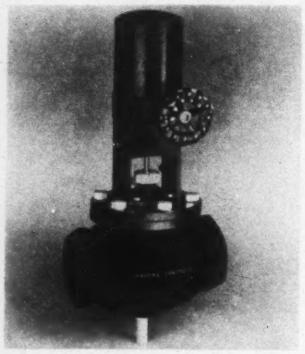


The four cutting wheels of this new heavy duty cutter (No. 42) provide better balance and handling of the cutter under all conditions, cut more evenly and save time in cutting iron, steel or brass pipe, according to the maker. Frame is of malleable alloy; capacity $\frac{1}{2}$ to 2 in.—Ridge Tool Co., Box 670, Elyria, Ohio.

Manual Reset Valve

No. 2072—The new "Series MR-1-2" valve is offered to fulfill a demand for a manual reset valve for positive control of water, air, gas, steam and oil in almost every industrial application, according to the manufacturer. The control is operated by an external magnetic operator not subject to dirty, viscous or high temperature fluids that the valve may be handling. Upon current failure the valve closes and cannot be opened until the current is available and then only by manually resetting it. Furthermore, there is no way to open the valve, or hold or prop it open, without restoration of current, it is stated.

The operator is equipped with a double release mechanism to minimize energy requirements for valve operation, which are quite low. These valves are available in sizes from $\frac{1}{2}$ to 6 in. IPS, screwed or flanged bodies. Although the unit is furnished with an iron body, bronze trim, special alloy bodies with stainless or special trims are available.—General Controls Co., 801 Allen Ave., Glendale, Calif.



Paint for Corrosive Conditions

No. 2073—A new grade of "Koroseal" paint, named "Koroplate," has been developed to protect metal surfaces against chemical reactions and is recommended by the maker for service under corrosive conditions.

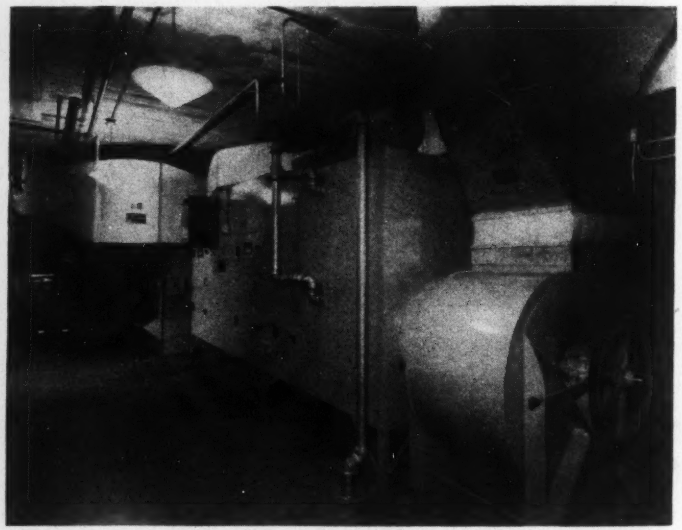
The paint is liquid at room temperatures and requires no heating before application. At ordinary temperatures it can be either brushed or sprayed. Applications include sour crude storage lines and underground pipe and gathering lines, and fume ducts in plating rooms.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

For AIR-CONDITIONING HOUSINGS

Carey FIREFOIL
LIGHT WEIGHT, STRONG
WATERPROOF, FIREPROOF
STRUCTURAL INSULATOR

This hardened asbestos, insulating board is unexcelled for construction of housings for enclosing various types of equipment. Excellent for plenum chambers, large ducts, housings, etc. Eliminates vibration; no rusting; no painting; water resistant; fireproof. CAREY Firefoil Panel consists of corrugated asbestos felts, firmly bonded and surfaced on each side with asbestos-cement sheathing. It is strong, rigid, light in weight. Maximum size sheets, 48" x 96". Thicknesses from ½" up.

Increase customer satisfaction . . . add to your profits . . . by using CAREY Firefoil Panel on your air-conditioning jobs. Write for Specification Sheet; address Dept. 25.



CAREY Firefoil panels, mounted on outside of metal frame, housing the air conditioning equipment of a modern system serving branch office of an electrical equipment manufacturer.

QUIET — FIREPROOF

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

Flameproofed Insulation

No. 2074—A new "Saferized" flameproof process for treating the redwood bark fibers from which "Palco Wool" insulation is made augments the inherent fire resistant qualities of the bark of the redwoods, the maker states.

This insulation was first generally introduced a decade ago when research engineers perfected a process for removing the wiry resilient fibers of redwood bark from the solids in which nature had embedded them. Especially designed machinery and equipment have been installed, and all insulation now being shipped is subjected to the flameproofing process as a regular step in its manufacture.—The Pacific Lumber Co., 100 Bush St., San Francisco, Calif.

Odor Removers

No. 2075—A new line of self-contained odor adsorbers —in addition to the manufacturer's portable "Odorsorber"—in wall and ceiling type units, has been announced. They consist of canisters containing specially processed "Dorex" activated coconut shell carbon, dust filters and either a propeller or blower fan to pull the contaminated air through the carbon and discharge it at room temperature.

According to the manufacturer, specific applications include hospitals, department stores, hotels, restaurants and lavatories of motion picture houses and theaters.

The units are available in a capacity range from 150 to 1500 cfm.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Rock Wool Sealed Blankets

No. 2076—Rock wool sealed blankets, with an approved vapor barrier on one side to resist condensation and crepe kraft on the other, have been added to a line of rock wool insulations marketed in felted bats, loose fiber and granulated forms. The new blankets are available in three thicknesses—thick, medium, and thin. The thick blanket, approximately 3 in., is 15 in. wide by 41⅓ ft long; the medium blanket, approximately 2 in. thick, is 15 in. wide and 62 ft long; and the thin blanket, approximately 1 in. thick, is 15 in. wide and 103½ ft long.

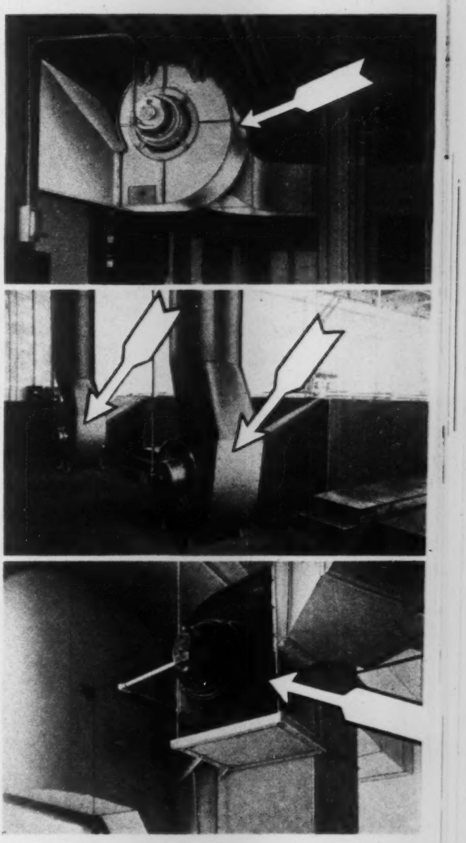
The blankets are applied with a vapor barrier to the room side and the crepe surface to the other side.

According to the manufacturer, these blankets are manufactured under strict laboratory control and to meet Federal Specifications HH-1-521b.—Philip Carey Co., Wayne Ave., Lockland, Cincinnati, Ohio.

FOR YOUR CONVENIENCE

For your convenience in obtaining more information about any of this equipment, see coupon on page 128. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

LOOK, ED...HERE'S OUR ANSWER! ILG HAS 64 DISCHARGE ARRANGEMENTS!



MOUNT 'EM ANYWHERE...
On Floor, Wall or Ceiling!

No apparatus you install is more *flexible* than ILG Direct-Connected Blowers! For you can mount 'em anywhere—on floor, wall, or ceiling—use one of 64 discharge arrangements—have motor on either side and change from right to left drive with any discharge!

Direct-Connection Solves Location Problems, Too!

Since recessed motor is direct-connected to blower wheel with a short motor shaft, overall space required for entire unit is little more than that needed by the blower alone. Think what that means when you bump into a tight corner placement!

To get this whole story . . . and description of ILG's other outstanding mechanical superiorities . . . send for Catalog EB-381 today!

ILG ELECTRIC VENTILATING CO.
2841 N. CRAWFORD AVENUE, CHICAGO, ILL.
Offices in 43 Principal Cities

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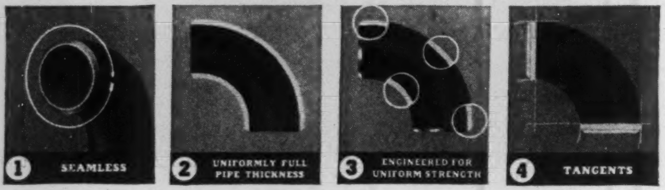
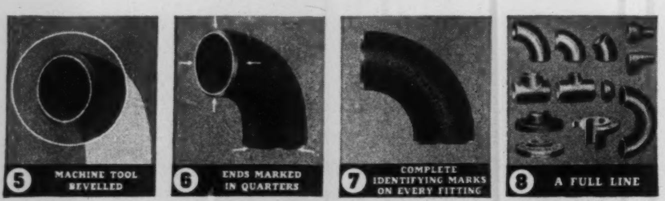
Vitalized VENTILATION
AND AIR CONDITIONING
AIR CHANGE . . . NOT JUST AIR MOVEMENT

TAYLOR FORGE


1 SEAMLESS
2 UNIFORMLY FULL PIPE THICKNESS
3 ENGINEERED FOR UNIFORM STRENGTH
4 TANGENTS

On your next job
make the acquaintance of the only welding fittings that offer you all these 8 aids to faster, easier welding.


5 MACHINE TOOL BEVELLED
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WeldELLS
Seamless Pipe Fittings for Welding

TAYLOR FORGE & PIPE WORKS
General Offices and Works: Chicago, P. O. Box 485
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Technical Experts Appointed by Army

Following is the list of technical experts which have been appointed by the war department to serve as staff executives in the offices of the nine zone constructing quartermasters of the construction division, office of the quartermaster general, as noted on page 49, front section, this month:

I Zone

(Major R. G. Richards, QMC, zone constructing quartermaster, Army Base, Boston, Mass.)
Zone engineer—W. G. Grove, Hartford, Conn.
Zone architect—Henry R. Shepley, Boston, Mass.
Zone operations officer—Peter F. Connolly, New York City.

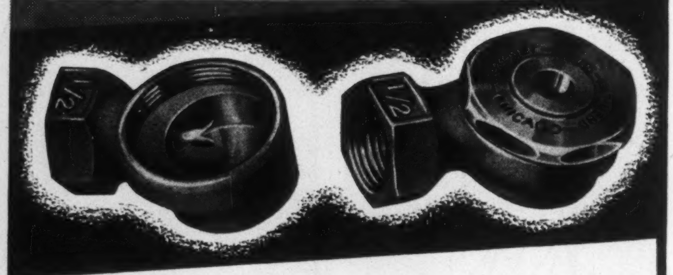
II Zone

(Lt. Col. M. A. McFadden, QMC, zone constructing quartermaster, 120 Wall St., New York City.)
Zone engineer—Enoch R. Needles, New York City.
Zone architect—Robert Barnard O'Connor, New York City.
Zone operations officer—H. M. Hale, Long Island, N. Y.

III Zone

(Major J. H. Burgheim, QMC, zone constructing quartermaster, Standard Oil Bldg., Baltimore, Md.)
Zone engineer—Charles H. Stevens, Philadelphia, Pa.

THE PERFECT NOZZLE FOR AIR CONDITIONING ...ROTOJET by BINKS



Rotojet breaks up the fluid into an ultra fine uniform spray. Specially designed for air conditioning, refrigeration and similar uses. Comes in a wide variety of sizes and capacities. Precision made of tough marine bronze. Also available in special alloys and stainless steel. WRITE FOR BULLETIN 250, which describes this and other BINKS spray nozzles.

BINKS MANUFACTURING COMPANY
3114 CARROLL AVENUE Dept. H440 CHICAGO, ILLINOIS

Zone architect—Louis McLane Fisher, Baltimore, Md.
Zone operations officer—E. C. Macy, Philadelphia, Pa.

IV Zone

(Colonel H. L. Green, USA, Retired, zone constructing quartermaster, Marietta Bldg., Atlanta, Ga.)
Zone engineer—Edward S. Bres, New Orleans, La.
Zone architect—J. W. Humphrey, Atlanta, Ga.
Zone operations officer—E. O. Korsmo, Memphis, Tenn.

V Zone

(Major B. F. Vandervoort, QMC, zone constructing quartermaster, 232 N. High St., Columbus, Ohio.)
Zone engineer—Camden Page Fortney, Charleston, W. Va.
Zone architect—Joseph Lewis Weinburg, Cleveland, O.
Zone operations officer—Thomas Bentley, Toledo, Ohio.

VI Zone

(Major E. C. Hayden, QMC, zone constructing quartermaster, Civic Opera Bldg., 20 North Wacker Dr., Chicago, Ill.)
Zone engineer—Robert Isham Randolph, Riverside, Ill.
Zone architect—C. Herrick Hammond, Chicago, Ill.
Zone operations officer—(To be appointed.)

VII Zone

(Major M. E. Townes, QMC, zone constructing quartermaster, c/o Corps Area, New Federal Bldg., Omaha, Neb.)
Zone engineer—Harry E. Frech, St. Louis, Mo.
Zone architect—Eugene S. Klein, St. Louis, Mo.

This Bulletin tells all about it

THERM-O-TILE
Reg. U. S. Pat. Off.

The Conduit for Underground Pipe Lines

THERM-O-TILE

- **Simplest**
- **Strongest**
- **Most Efficient**

Monolithic concrete base. No broken stone fill. Strong arched construction. No bell joints. Internal channel drain. Etc. There are ten other reasons why Therm-O-Tile is the superior conduit system. Treated fully in Bulletin 381, shown at the left.

Therm-O-Tile is sold and installed by Johns-Manville Construction Units in all Principal Cities.

See our page in Sweet's or The Heating Guide.

H. W. PORTER & CO., Inc.
822-H Frelinghuysen Ave., Newark, N. J.

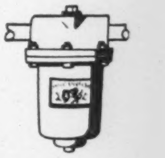
Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job on which we shall be glad to have your ☐ comments ☐ quotations.

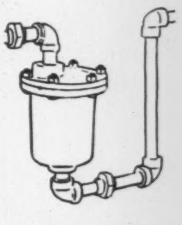
Name ....
Firm ....
Street ....
City ....State ....

How GOOD are Your Steam traps?

	ANDERSON SUPER-SILVERTOP	TRAP "X"	TRAP "Y"	TRAP "Z"
Long Service Life	YES	YES	?	YES
Average Repair Cost	VERY LOW	LOW	?	LOW
Straight-Line Piping	YES	NO	YES	NO
Low Cost Installation	YES	NO	YES	NO
Easy To Inspect	YES	NO	YES	NO
Guided Bucket	YES	NO	NO	NO
Valve and Seat Easy To Remove	YES	NO	YES	YES
Works on Vacuum	YES	YES	NO	YES
Self-Cleaning Trap	YES	NO	NO	NO

COMPARE THEM TO ANDERSON SUPER-SILVERTOPS





Upper illustration is an Anderson Super-Silvertop showing simplified piping. Lower shows puzzle piping of old style inverted bucket trap.

◆ Compare your steam traps to Anderson Super-Silvertop. Compare any steam trap to Super-Silvertop and see why thousands of trap users are changing to the engineered inverted bucket steam trap!

Anderson Super-Silvertops are connected either straight-in-line or as an elbow, no extra fittings to buy or install. That means neater piping layouts and a saving of as much as seven fittings and an hour of installation time *per trap!*

Get all the facts about Super-Silvertop, the long-life inverted bucket trap with simplified piping—send for your free copy of "How To Choose a Steam Trap," a helpful, handy steam trap manual, write today.

THE V. D. ANDERSON CO.
1949 W. 96th Street • Cleveland, Ohio

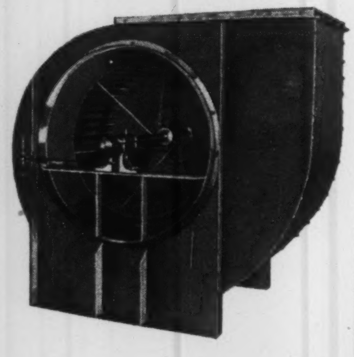
Super-Silvertop STEAM TRAPS

for ANY HEATING and VENTILATING Requirement SPECIFY BISHOP & BABCOCK EQUIPMENT

Serving the Industry since 1879

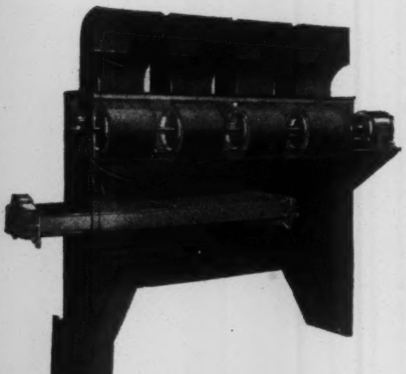
VENTILATING FANS

Whatever your ventilating problem, you will find a practical economical solution in selecting a Bishop and Babcock product. With the Squirrel Cage Type Fan made in all standard sizes from 6" diameter wheels to as large as 96", delivering from 250 to 500,000 C.F.M., combined with the Streamline Fan in standard wheel diameters from 18" to 75", you can specify a Bishop and Babcock unit for any ventilating requirement.



UNIT HEATERS

There is a size and model Bishop and Babcock Steam or Hot Water Unit Heater to meet your every requirement. Propeller Type and Blower Type for both ceiling and floor mountings in a complete range of sizes. Full information is available, write for bulletins.



TERRITORIES AVAILABLE FOR REPRESENTATIVES

The BISHOP & BABCOCK MFG. CO.
CLEVELAND, OHIO.
REPRESENTATIVES IN PRINCIPAL CITIES

Zone operations officer — C. R. Conkey, Minneapolis, Minn.

VIII Zone

(Lt. Col. E. V. Dunstan, QMC, zone constructing quartermaster, Fort Sam Houston, San Antonio, Tex.)

Zone engineer—Edward N. Noyes, Corpus Christi, Tex.

Zone architect—Major Roy Leibsle (Reserve Officer), San Antonio, Tex.

Zone operations officer — F. G. Chamberlain, San Antonio, Tex.

IX Zone

(Lt. Col. E. M. George, QMC, zone constructing quartermaster, c/o Constructing Quartermaster, San Francisco & Vicinity, Calif.)

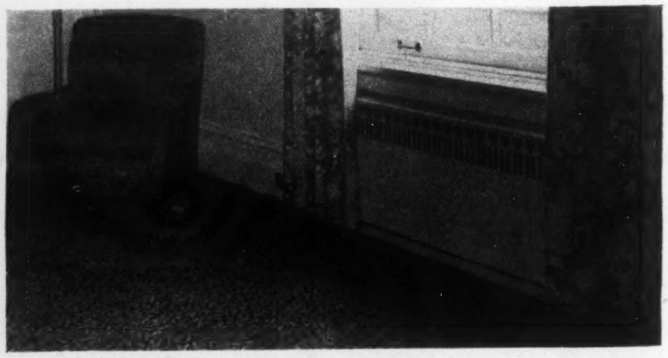
Zone engineer—Harry W. Dennis, Los Angeles, Calif.

Zone architect—Timothy L. Pflueger, San Francisco, Calif.

Zone operations officer—E. T. Foley, Pasadena, Calif.

The above-listed zone engineers, architects and operations officers were selected for the consideration of the chief of construction by the construction advisory committee to the army and navy munitions board, composed of J. D. Hogan, chairman; Ernest J. Russell, architectural member; E. P. Palmer, contractor member; Malcolm Pirnie, water supply member; and H. E. Foreman, director of the Associated General Contractors of America.

Outstanding . . .
in beauty and performance



THE SHAW CONVECTOR-RADIATOR

In addition to comfortable heating, one of the prime requisites of convector radiators is pleasing appearance. Installations in many new and modernized rooms must harmonize with the surroundings as well as perform with utmost efficiency. The Shaw-Perkins Convector-Radiator with its compact space-saving design, economical installation and highly efficient heat distribution will enable you to complete your installations to the satisfaction of the most critical customer.

Write today for our booklet "Modern Radiation."

SHAW-PERKINS MANUFACTURING CO.
Oliver Building Pittsburgh, Pa.

Useful Information

Recovery of Sulphur Dioxide

Engineering Experiment Station bulletin No. 324 of the University of Illinois, Urbana, Ill., is on the subject of The Recovery of Sulphur Dioxide from Dilute Waste Gases by Chemical Regeneration of the Absorbent. It is a report of an investigation conducted by the Engineering Experiment Station in coöperation with the Utilities Research Commission, by H. Fraser Johnstone, Professor of Chemical Engineering, and Alamjit D. Singh, Special Research Assistant in Chemical Engineering. The price of the 140 p. publication is $1.00, although a limited number of copies are available for free distribution.

A new process for recovery of sulphur dioxide from dilute waste gases is described. Investigation in the laboratory and a pilot plant has shown that the process is workable.

The principal objects of the investigation were to study methods for eliminating sulphur dioxide from boiler furnace gases resulting from combustion of high sulphur coal, and to develop the processes in order that an accurate engineering design and cost estimate could be made. A fundamental viewpoint of the work was that elimination of sulphur dioxide from combustion gases requires recovery of the sulphur in some form which has commercial value.

GUARD
COLD AIR DUCTS AND PIPING
WITH *Novoid*

YOU can give air ducts and piping lasting protection when you insulate with NOVOID CORKBOARD and CORK COVERING. This pure cork insulation bars the passage of heat, prevents duct and pipe line condensation, and helps control temperatures within desired ranges. For details and name of nearest Novoid Distributor, write Cork Import Corp., 330 W. 42nd St., New York City.

NOVOID CORK INSULATION

SPECIFY YOUNG
FOR
High Efficiency
HEATING

Copper alloy tubes are rolled (not brazed) into sturdy, cast alloyed iron headers—then reinforced with snug-fitting ferrules for greater strength, longer life.

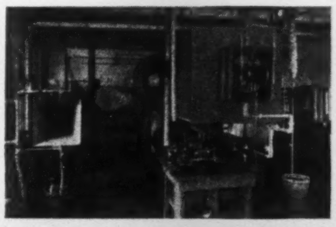
Type "SH" Unit Heater Catalog No. 2738

Type "FH" Unit Heater Catalog No. 336

VERTIFLOW Unit Heater Catalog No. 2540

Young heating units have a record of high efficiency and economy in all types of installations. That's because every step in their production—design, selection of materials, fabrication and final testing—must meet rigid standards to insure the highest degree of heating efficiency. Painstaking research in the laboratory and in the field assures you that their performance will meet the most exacting requirements of modern heating plants. Available in a wide selection of sizes and capacities. For complete details write:

YOUNG RADIATOR COMPANY, Dept. 111-C, Racine, Wisconsin
Offices In All Principal Cities.



CERTIFIED CAPACITY

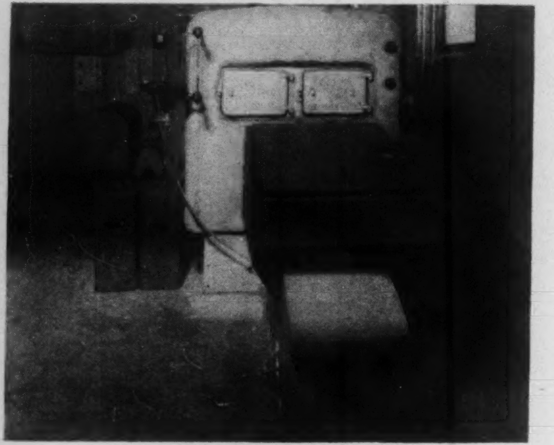
All Young units are tested and rated for heat output and air delivery in accordance with Standard test codes of the American Society of Heating and Ventilating Engineers.

Young
High Efficiency
HEATING COOLING AND
AIR CONDITIONING UNITS

UNIT HEATERS • CONVECTORS • CONDENSERS • EVAPORATORS • AIR CONDITIONING UNITS • HEATING COILS • COOLING COILS

Young Quality

OIL COOLERS • GAS, GASOLINE, DIESEL ENGINE COOLING RADIATORS • INTERCOOLERS • HEAT EXCHANGERS • ENGINE JACKET WATER COOLERS



Hank Tells—

How He Helped
A Church
To Save 20%

GETTING all het up on religion is a lot easier—and costs less—than keeping the heat up fur religion.

Take the Quarryville Methodist Church, near Lancaster, Pa., in the old days when folks wore red flannels, woolen stockings, and mittens, the congregation kept their bundlings on in church and put up with their warm air heatin' contrapshun.

But the young folks wearing silk stockings, wouldn't stand fur no sich puttin' up.

So, they got Wm. Dupree of Lancaster, Pa., ter rip the warm air out, and put in a Burnham boiler and a two pipe steam system. Two Master Stokers wuz used on that one big boiler.

The hull church and a big gathering place is now het up on 20 percent less fuel.

The gals is goin' ter church agin, and the fellers ain't wearing their ear laps inside the mettin' house.

Maybe the old folks go ter sleep oftener, because the shivers ain't keeping 'em so much awake.

So, it looks as if radiator heat wuz having a big hand these days in bringin' folks back ter church going. With the 20% saving on fuel, they can cut the corners on the collection plate and still get by. Religion comes easier and stays longer, when it comes radiator warm and comfortable like.

HANK HINDLE

Burnham Boiler Corporation
Distributed Through Wholesalers
Irvington, N. Y., Dept. P Zanesville, Ohio, Dept. P
Branch Offices In All Principal Cities
Export Dept.: 50 Church St., New York City

Burnham Boiler

Book Reviews

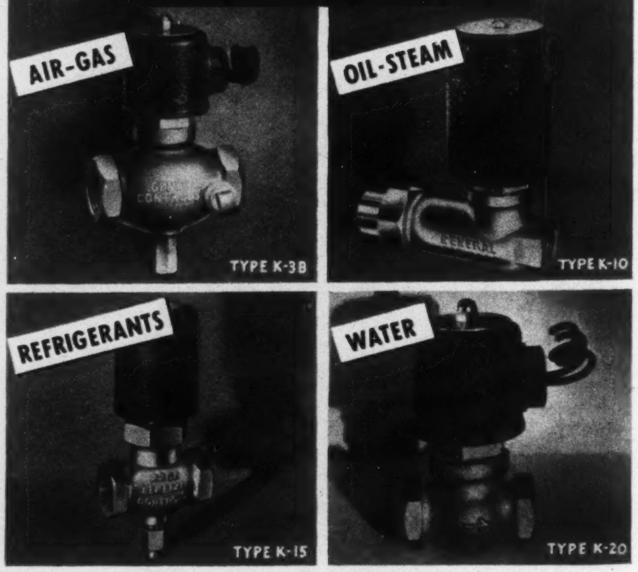
Measurement and Control of Temperature

[Temperature—Its Measurement and Control in Science and Industry, a collection of papers presented at a symposium held November, 1939, under auspices of American Institute of Physics with the coöperation of the National Bureau of Standards and the National Research Council. 1941. 1362 + xiii pp., 6 x 9 in., clothbound. Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y. Price, $11.00.]

This monumental and valuable work comprises an extensive collection of papers prepared by various authorities in the field of temperature measurement and control and many of its ramifications. The symposium at which these papers were originally presented was planned to coördinate the treatment of the subject of temperature in the several branches of science and engineering, to review fundamental principles and to recapitulate recent progress, to emphasize the importance of temperature as a branch of physics, and to improve technical curricula through making the latest information available. That these objects have been achieved is apparent from an inspection of this volume.

The work is divided into 13 chapters on temperature and temperature scales, precision thermometry, education, natural sciences, temperature in biology, temperature and its regulation in man, automatic temperature

★ GENERAL CONTROLS ★
SOLENOID VALVES
SUITABLE FOR EVERY GAS, LIQUID AND VAPOR



COME TO HEADQUARTERS FOR ALL YOUR NEEDS FOR SOLENOID VALVES

Pioneers and leaders in the manufacture of quiet A.C., trouble-free, 2-wire controls, for all services. Write today for complete Catalog. Nationwide sales and service.

GENERAL CONTROLS
267 Fifth Avenue
New York City
350 East Ohio Street
Chicago, Ill.

regulation and recording, special applications and methods, general engineering, metals and ceramic industries, oil industries, optical and radiation pyrometry, and thermometric metals and alloys. Each of these chapters is made up of numerous contributions by individual authorities on specific phases of the respective subjects.

Sales Engineering

[Sales Engineering, by Bernard Lester, Westinghouse Electric & Mfg. Co. 1st ed. 1940. 200 + vii pp., 5½ x 8½ in., clothbound. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. Price, $2.00.]

The purpose of this new book is to place before the younger sales engineer, in simple terms and without sales promotional adornment, the principles of sales engineering—which the author defines as "the art of selling equipment and services which require engineering skill in their selection, application and use." The author covers the principles of sales engineering, indicating the importance of this work and suggesting the opportunities it presents.

The book is written in a style which makes it most readable and interesting. The scope of the work is divided into three main parts—the field of sales engineering, the work of the sales engineer in selling, and the training and development of the sales engineer. A number of specific examples of situations which have been confronted and solved by sales engineers add color to the discussion.

IN A HURRY?
Get it tight the first time
with a
DART UNION

There's no try-try-again for tight joints—no costly delays—when you hook-up with Darts. For Darts make up *tight the first time*, quickly, easily. They're made that way. They've got two bronze seats, ground and matched for quick, sure tightness. Extra heavy malleable iron bodies and nuts, to minimize stretch and withstand wrench abuse. And remember this. A dart is good for more than just one tight joint. You can install it again and again and get tight joints every time. Next time you ask for a Union, ask for a Dart.

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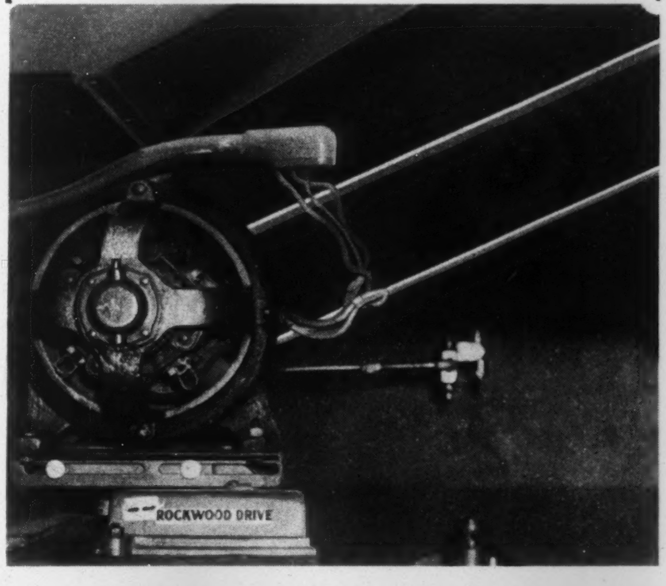
"BEST INVESTMENT WE EVER MADE" . . . *says the electrician of a famous N. Y. newspaper*

Replacing a troublesome flexible coupling drive for a fan drawing off gas from metal pots on linotype machines, a TANNATE-ROCKWOOD drive was installed on June 4, 1940. Since then, it has operated 16 hours a day in a temperature of 120 degrees . . . with complete satisfaction!

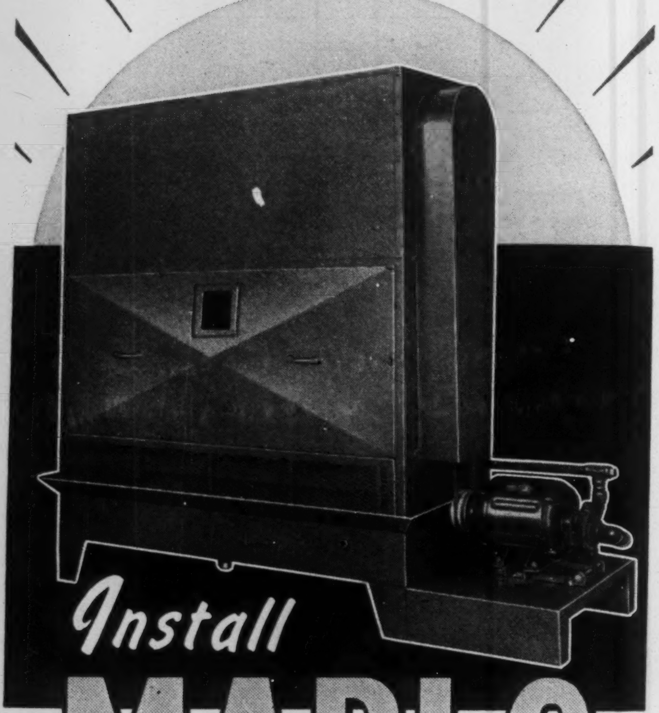
TANNATE-ROCKWOOD is one of the most efficient types of short center drive yet engineered . . . has great gripping power and flexibility. Proper tension is maintained automatically, maximum production always assured.

Let's talk about TANNATE-ROCKWOOD in relation to your needs. Write. There's no obligation.



STEP UP PRODUCTION WITH
RHOADS
Founded 1702
Tannate-Rockwood
the ideal
SHORT CENTER DRIVE

J. E. RHOADS & SONS • 35 N. SIXTH ST., PHILA., PA.
NEW YORK • CHICAGO • ATLANTA • CLEVELAND



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EVAPORATIVE CONDENSERS

Available in a complete range of sizes . . . 1-100 tons. For ANY refrigerant. Indoor or outdoor models. All prime surface coils.

Efficient Marlo "Uni-Drive." Hot galvanized construction, sectional design. Lifetime-lubricated ball-bearing equipped. Silent operation.

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MARLO COIL COMPANY
6135 Manchester Ave. · St. Louis, Mo.
Refrigerating Equipment Manufacturers

Boiler Operator's Guide

[Boiler Operator's Guide, by Harry M. Spring, Jr., Boiler Inspector and Licensed Chief Engineer. 1st ed. 1940. 353 + xi pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. Price, $3.00.]

This new handbook covers the construction, operation, inspection and maintenance of steam boilers and includes over 300 typical steam engineer's examination questions and answers. It has been the author's purpose to make the text sufficiently non-technical to "benefit the man starting at the foot of the ladder and yet contain information of interest and value to the man at the top."

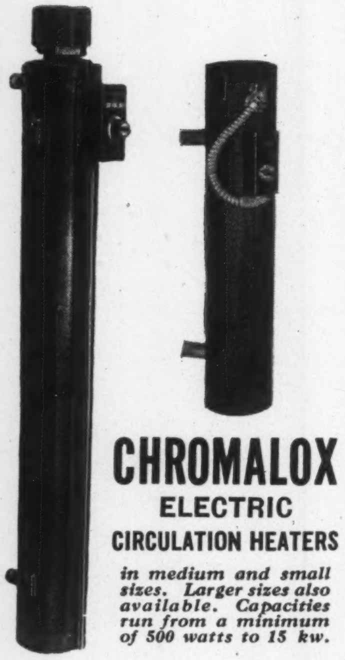
Chapters are given on general construction and stress calculations, fire tube boilers, water tube boilers of the straight tube and bent tube types, on boiler appliances and auxiliaries, boiler plant management and problems of plant operation.

There are also appendices on boiler terms, materials, boiler scale, instructions for riveted patches, and on boiler safety rules.

Mechanics of Liquids

[Mechanics of Liquids, by Ralph W. Powell, Associate Professor of Mechanics, Ohio State University. 1st ed. 1940. 271 + xii pp., 6 x 9 in., clothbound. Published by the MacMillan Co., 60 Fifth Ave., New York, N. Y. Price, $3.50.]

This new elementary text on hydraulics and fluid mechanics is a revision of a preliminary edition prepared in 1938 and used in classes at Ohio State.



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in medium and small sizes. Larger sizes also available. Capacities run from a minimum of 500 watts to 15 kw.

Big savings in fuel oil cost are being obtained by industrial users who use electric heat, particularly in cold starting of burners, to preheat heavy oils such as No. 5 and Bunker C. These grades cost less and contain higher Btu. values than the more refined product, thus providing a double saving.

The simple circulation heater illustrated is serving in very many oil-fired plants, as well as for domestic use, in its smaller sizes. It can be installed anywhere in the line, costs little to operate, and can be controlled with thermostat or manually. The heating element is a Chromalox Immersion Unit, furnished with a suitable housing. Similar units are widely used for heating water and other liquids, with heater blades sheathed in metals required to resist corrosion.

The Chromalox Book of Electric Heat describes this and many other applications of electric heat. At your request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

In his preface, the author points out that in the past few years there has been a great deal of discussion of fluid mechanics versus hydraulics, but thinking of these as two competing subjects is a great mistake, in his opinion. The question, he believes, is closely analogous to the corresponding situation in the mechanics of materials (solids), where the teacher of strength of materials does not consider the theory of elasticity as a competing subject but as the primary control with which he must constantly check.

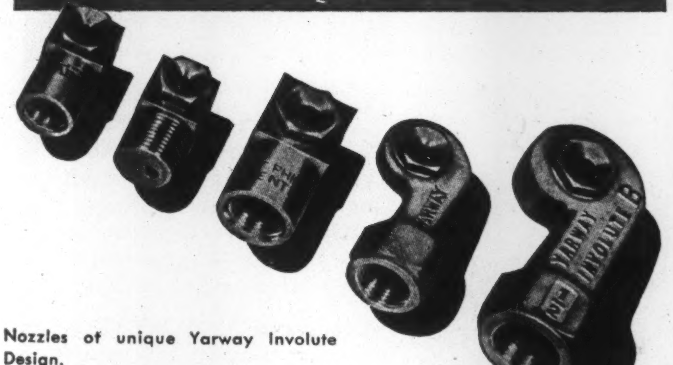
Because of the complete treatment of fluid flow and flow in piping given in this book, it should be of interest to many engineers concerned with design of piping for plants and buildings. There are eight chapters covering hydrostatics; fundamentals of fluid flow; orifices, tubes, nozzles and weirs; pipe flow (two chapters); flow in open channels; effect of viscosity; and the use of hydraulic models. Appendices are given on properties of liquids (including tables, and with alignment charts for solving various problems); dimensional analysis; and the rational basis for Nikuradse's formulas.

Air Conditioning Principles

[Air Conditioning Principles, by Charles Osborn Mackey, Professor of Heat-Power Engineering, Cornell University. 1st ed. 1941. 210 + x pp., 6 x 9 in., flexible binding. Published by International Textbook Co., Scranton, Pa. Price, $2.00].

This work is a newcomer to the rapidly growing list of books on air conditioning. It is one of the "International

AIR CONDITIONING
NOZZLES



Nozzles of unique Yarway Involute Design.

No internal parts or vanes to clog or erode.

Insure trouble-free air washing service.

Sizes and types for all requirements.

Many large users—installations total more than 5 million gallons per minute in water cooling and air conditioning service. Write for Bulletin N-615.

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GENERATE
MORE STEAM
PER SQUARE FOOT
OF
HEATING SURFACE
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WATERTUBE
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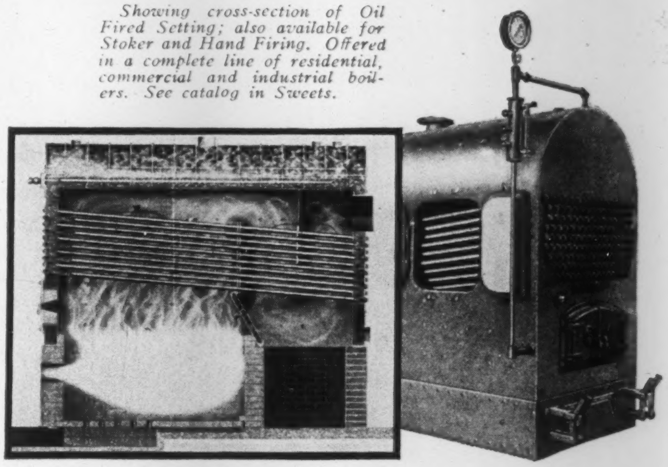
The conservation of fuel, and the ability of a boiler to pick up heavy and continuous overloads, in excess of the boiler rating, are vital demands of the day.

International "FUEL SAVER" Water Tube Boilers give this flexible service to modern heating systems and industrial power plants. Actual performance records show efficiencies noticeably greater than other types of like size.

Therefore we recommend that you become fully familar with "FUEL SAVER" Water Tube Boilers.



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Write for convincing proofs and details.

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"FUEL-SAVER"
WATER TUBE
STEEL HEATING & POWER BOILERS

Low Pressure Units 1/4 to 15 Hp.

Direct-Drive Ammonia Units, 1/2 Hp.

Freon-12 Units, 10 to 30 Hp.

4 Large 2-Cyl. Frick Compressors in Air Conditioning Service at the Philcade and Philtower Buildings, Tulsa, Oklahoma.

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Large 4-Cyl. Compressors in 5 Sizes

Texts in Mechanical Engineering," for which Prof. Charles Fayette Taylor is the consulting editor.

In a foreword, Dr. Willis H. Carrier points out that the author not only successfully integrates previous developments by others of the theory of the art of air conditioning, but in many instances rounds out both the theory and its application with further developments of his own. Among such original contributions are the further development of the Arnold theory of the wet bulb temperature, a new psychrometric formula, application of the contact mixture theory to solution of problems, and the estimation of variable heat flow through sunlit walls.

The treatment of the subject is limited to analysis of air conditioning processes, with no attempt to give a complete description of the equipment and controls required. There are chapters on properties of air, water vapor, and mixtures of air and water vapor; processes of mixtures of air and water vapor; physical and physiological principles; state and rate of supply of conditioned air; humidifying of air; heating and humidifying of air; heat and water vapor losses from buildings; dehumidifying and cooling of air; apparatus dew point and the cooling cycle; heat and water vapor gains in buildings; and transmission and distribution of air.

There are a number of problems given in the text and the answers are included in the back of the volume.

The appendix includes a large psychrometric chart and tabular data on air conditioning coils for the use of students.

DIRTY FILTERS can ruin the efficiency of the best air-conditioning system made....

THIS Hays Air Filter Gage gives a constant check on Air Filter conditions. It prevents changing filters sooner than necessary and warns when they are clogged with dirt.

The Hays Air Filter Gage is permanently and easily installed — nothing to get out of order. Will last as long as the duct work. Write 990 Eighth Avenue, Michigan City, Ind., for special Bulletin No. 40-278.

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SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
MICHIGAN CITY, INDIANA, U.S.A.

In store, building or factory, heating equipment should be QUIET

SPECIFY

DELCO MOTORS

Dynamically Balanced

The benefits of Delco motors' *exceptionally quiet operation* have been demonstrated in heating and air-conditioning applications of all sizes.

Most important factor in assuring quiet running is Delco Products' accurate dynamic-balancing operation, by which motor vibration is reduced to a practical minimum. Other contributing factors are the carefully maintained alignments . . . the special emphasis placed on attaining an accurate shaft-bearing fit . . . and the elimination of rotor wobble by indexing the rotor hole and key-way to make certain they are in the same plane.

Even without the advantage of quieter operation, the selection of Delco motors would be justified on the basis of all-round ruggedness. Coils are insulated with highest quality materials; generous use of materials in frame, feet and radiating ribs provides increased strength as well as cooler operation; contact surfaces are machined in extra operations for better heat dissipation; and the inner race of the bearing is locked on the shaft to prolong bearing life.

Delco motors meet the most exacting demands for dependability on industrial machines in large factories; they will more than satisfy your heating and air-conditioning requirements. Consult the Delco Products Engineering Department for recommendations.

DELCO MOTORS

DELCO PRODUCTS
DAYTON, OHIO

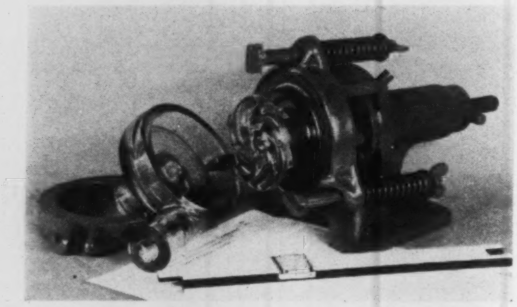
DIVISION OF GENERAL MOTORS CORPORATION

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Small All Glass Pump

No. 2077—The success of the 1½ in. x 2 in. centrifugal pump of "Pyrex" brand glass announced a few months ago has created a demand for a smaller size, the manufacturer states. A ¾ in. × 1 in. pump with a capacity of 10 gpm has therefore been made available for smaller installations and for laboratory and pilot plant service.



Like the larger pump, the new size is constructed of glass—volute, head and rotating impeller—and is fully transparent. It is of particular advantage where corrosive liquids or liquids which must be kept chemically uncontaminated are to be handled. It will handle hot acids or brine cooled liquids with equal facility and therefore offers the solution to many chemical, process and food plant problems.

A unique mechanical seal replaces the conventional stuffing box and a safety unloading device eliminates possibility of fracture of the glass casing, it is pointed out.—Nash Engineering Co., South Norwalk, Conn.

Pneumatic Control Valve

No. 2078—A new pneumatically operated control valve has been announced which incorporates many unique features, according to the manufacturer.

Characterized movement of the valve disc is accomplished by means of a scissors type linkage which permits accurate control near the closed position of the valve where most needed.

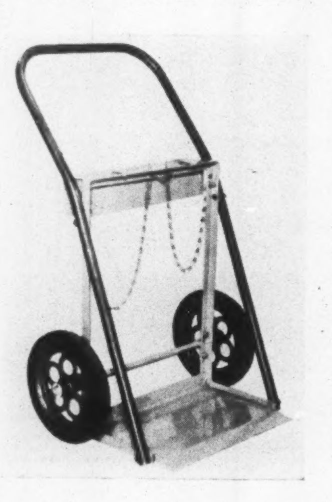
Undesirable effects of variable steam pressure and friction in the packing gland are overcome by the action of a built-in "Gradutrol" relay designed to provide maximum power to change the position of the valve disc even for very slight changes in demand by the controller.

Specially constructed bellows of molded "Neoprene" are used in the power unit to assure long operating life and provide a maximum of power in a minimum of space. Other features include an external indicator to show the position of the valve disc, a simple means for converting the valve from a "normally closed" type to a "normally open" type or vice versa, and adjustments for maximum and minimum flow and for throttling range.

The valve body is single seated, bronze with brass trim in sizes from ½ to 3 in. for screwed connections. The characterized v port guide may be adjusted for lift up to ¾ in. maximum.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Cylinder Truck

No. 2079—A new hand truck designed to carry an oxygen cylinder, an acetylene cylinder, and a complete welding and cutting outfit—known as the "Oxweld T-7" —is light in weight, well balanced, has 14 in. wheels equipped with semi-pneumatic rubber tires, and weighs considerably less than the former all steel wheeled trucks which it replaces, the maker states.



These features make the truck easy to maneuver, and it is easy to handle over rough places. The new design results in a 4½ in. reduction in overall width of the truck, permitting passage through narrower openings. As an added feature, the size of the removable metal tool box for extra blowpipes, tips, goggles, and wrenches, has been increased.—The Linde Air Products Co., Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

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Heating, Piping and Air Conditioning, [4-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2077	2078	2079	2080	2081	2082	2083	2084	2085	2086
2087	2088	2089	2090	2091					
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3836	3837	3838	3839	3840	3841	3842	3843	3844	3845
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INDUSTRIAL OIL BURNING SYSTEMS

Heating contractors can easily match a Petro system to any size job. Every Petro system is designed to meet the specific requirements and characteristics of the particular job it is ordered for—and maintain high firing efficiency. Contractors installing a Petro system are supplied with complete engineering cooperation, including a detailed layout if desired, as part of Petro's Trade service. Even more important—the contractor can be certain that Petro is going to deliver the efficient operation desired by cost-conscious management. Combustion efficiency is held at a fixed constant in all Petro units . . . even when the fuel is pre-heated No. 6 (Bunker C) oil because the Petro Thermal Viscosity System controls the heat applied to the oil. This system, alone, permits wholly automatic operation because it eliminates all need for the frequent manual adjustments required by mechanical control of pre-heated oils.

24% Saving on coal cost

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$8 per room

54% yearly saving compared with coal

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Capacities—to 145 gallons per hour—454 Boiler h.p.—68,000 Sq. Ft. Steam

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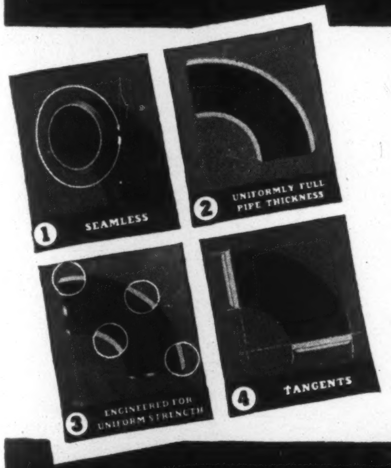
1 SEAMLESS
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use WeldELLS, the fittings that offer you more features than any other welding fittings to speed welding and guard against trouble

5 MACHINE TOOL BEVELLED
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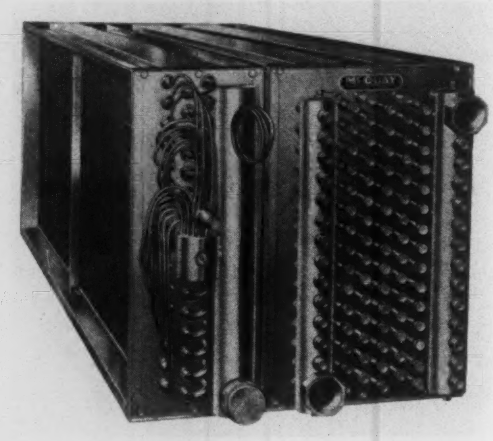
TAYLOR FORGE & PIPE WORKS: General Offices and Works: Chicago, P.O. Box 485
New York Office: 50 Church St., Philadelphia Office: Broad Street Station Bldg.

Air Conditioning Coils

No. 2080—For use when a sufficient supply of cold water is available, a new line of water type air conditioning coils has been announced. In some installations it is possible to utilize the coils for both heating and cooling, according to the manufacturer.

Where water conditions are such that cleaning of the tubes is necessary, the "Type RP" removable plug coil has been developed. The non-ferrous removable plugs at both ends of all tubes provide ready access for internal cleaning of the tubes without removing pipe connections, it is stated.

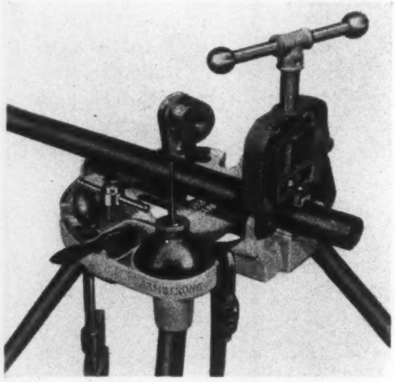


The illustration shows a combination water cooling and direct expansion coil for central fan systems and industrial applications.—McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.

Heavy Duty Vise Stand

No. 2081—The new heavy duty "No. 933 Vistand" is designed for either portable or stationary use. It has spreads of 50 in. in front and 43 in. from front to rear leg, and won't tilt or tip, says the maker.

The features of the platform, which measures 14 in. in both width and depth, include tool notches and slots around the rim, oil can recess, and a special "dope" pot. Equipment also includes three benders—one for ¾ in. pipe, and reverse benders for ½ in. and ¾ in. pipe—placed directly over the right front leg to prevent tipping during the bending operation. The unit has a ceiling brace and its feet are punched for attaching to the floor—or it may be used with the manufacturer's new skidless rubber "shoes" that prevent skidding or scratches on polished floors.



A new side open pipe vise which may be installed on a bench or for special purposes on the side or rear of a service truck has also been developed. It takes pipe

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THE recommendation of a Patterson-Kelley Co. Engineer meant a $2,000.00 saving a year to the Shirreffs Worsted Co., Fitchburg, Mass.

Utilizing the Patterson System of Heating Water—which for 61 years has been the most economical method of producing hot water in quantities—a saving was effected of more than one ton of coal daily.

The practical engineering experience of a Patterson-Kelley representative is available at all times to Consulting Engineers, Heating Contractors and Architects. There is no obligation or charge for their services.

Why not ask one to call—today? Write for catalog.

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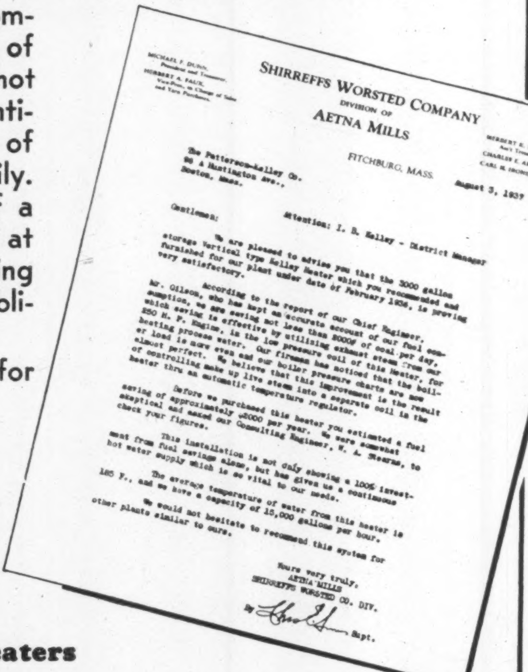

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FITCHBURG, MASS. August 3, 1939

The Patterson-Kelley Co.
80 A Huntington Ave.,
Boston, Mass.

Attention: I. B. Kelley - District Manager

Gentlemen:

We are pleased to advise you that the 3000 gallon storage Vertical type Kelley Heater which you recommended and furnished for our plant under date of February 1936, is proving very satisfactory.

According to the report of our Chief Engineer, Mr. Gilson, who has kept an accurate account of our fuel consumption, we are saving not less than 2000# of coal per day, which saving is effective by utilizing exhaust steam from our 250 H. P. Engine, in the low pressure coil of this Heater, for heating process water. Our firemen has noticed that the boiler load is more even and our boiler pressure charts are now almost perfect. We believe that this improvement is the result of controlling make up live steam into a separate coil in the heater thru an automatic temperature regulator.

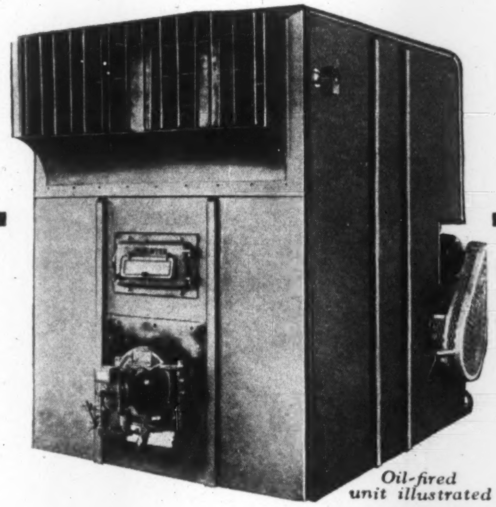
Before we purchased this heater you estimated a fuel saving of approximately $2000 per year. We were somewhat skeptical and asked our Consulting Engineer, W. A. Stearns, to check your figures.

This installation is not only showing a 100% investment from fuel savings alone, but has given us a continuous hot water supply which is so vital to our needs.

The average temperature of water from this heater is 185 F., and we have a capacity of 15,000 gallons per hour.

We would not hesitate to recommend this system for other plants similar to ours.

Yours very truly,
AETNA MILLS
SHIRREFFS WORSTED CO. DIV.
By Supt.



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REPEAT orders after years of service prove the benefits of proper, heavy-duty design in Directherm heaters.

Six sizes are available from 300,000 to 1,700,000 Btu's capacity.

Reasonable deliveries now available.

Write for complete literature and specifications or forward blueprints for estimates and recommendations.

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J-M ROCK CORK DOES THIS THREE-WAY JOB

ROCK CORK INSULATION on air-conditioning duct before application of cement finish.

Rock Cork provides permanent efficiency! Unusually moisture resistant, minimizes moisture infiltration . . . the cause of most low-temperature insulation failures. Installations made many years ago still retain their high insulating effectiveness . . . show no signs of deteriorating.

Rock Cork provides installation savings! Light in weight and easy to handle, Rock Cork can be quickly applied. On the job, costs stay low. For Rock Cork is basically mineral . . . rotproof, unusually durable. Little maintenance is required.

Rock Cork provides low initial costs! You pay no more for Rock Cork than for other low-temperature insulations. And you're sure of complete uniformity, for Rock Cork is made to an exact formula under rigid laboratory control.

You should have all the facts on the advantages J-M Rock Cork offers for use on refrigerating equipment, cold lines and air-conditioning ducts. Write for brochure DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE
JM ROCK CORK
LOW-TEMPERATURE INSULATION. IN SHEET FORM AND FOR PIPE COVERING

from ⅛ to 2 in.—Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.

Window Air Conditioner

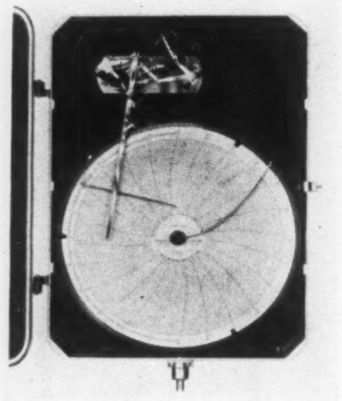
No. 2082—A new, portable window type air conditioner combining the functions of true summer air conditioning is an important innovation in the manufacturer's 1941 line of models, it is announced. It has a 5700 Btu capacity. In addition to the window model, there are three new floor type portable air conditioning units. First of these is a 7500 Btu room "Weathermaker," the second is a 9300 Btu de luxe room unit, while the third will develop 18,000 Btu—sufficient for large rooms in hot climates.

In addition to the functions of summer air conditioning, the window unit provides means for controlled ventilation as well as acting as an exhaust fan. Outside noises are subdued by special acoustical treatment in the design.

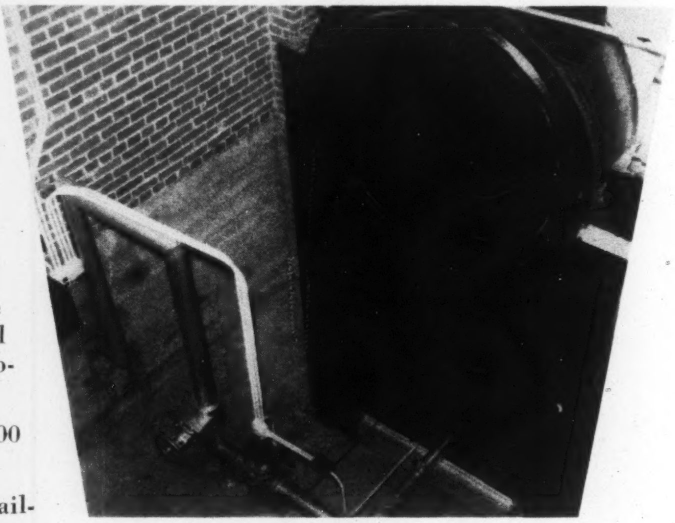
A simple control makes it possible to mix outdoor and room air in any proportion desired, a beneficial feature in spring and fall. A smoke exhaust flushes out tobacco smoke and other odors.—Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Recording Thermometers

No. 2083—Two new recording thermometers of the liquid filled type, known as the case compensated class I recording thermometer and the fully compensated class I recording thermometer, have been developed. Improved design and construction of the measuring elements, tubing, and bulbs in these instruments extend the field of application of the liquid filled thermometer, making it possible to take advantage of the desirable characteristics of the class I thermometer system on a greater variety of temperature measuring problems, according to the manufacturer.



The case compensated instrument is offered in temperature ranges up to 400 F and tubing lengths up to 10 ft or longer, depending upon conditions surrounding the installation. The fully compensated thermometer may be had in ranges up to 400 F equipped with 200 ft or less of con-



Efficiency First

WECO-N.G.E. Series F600

BURNER

The right size burner can always be selected for the load. Easy to install in any metal firebox or sectional boiler. Designed for trouble free operation with automatic controls.

Operates on straight natural gas and mixed gas to 800 B.t.u.

WECO-N. G. E. Series F600 GAS BURNERS are available for ratings from 50,000 B.t.u. to 10,000,000 B.t.u. output. This is the only burner of its type that features Multiple Port Interchangeable Grills, an Improved Type Venturi, and a Unique Baffle system.

This burner installation in the Texarkana, Texas, plant of one of the world's largest FOOD PRODUCTS organizations is developing 150 h. p. in a 100 h. p. boiler. It is equipped with full-on and full-off controls and an instantaneous flame failure safety device.

Write for Bulletin!

THE WEBSTER ENGINEERING CO.

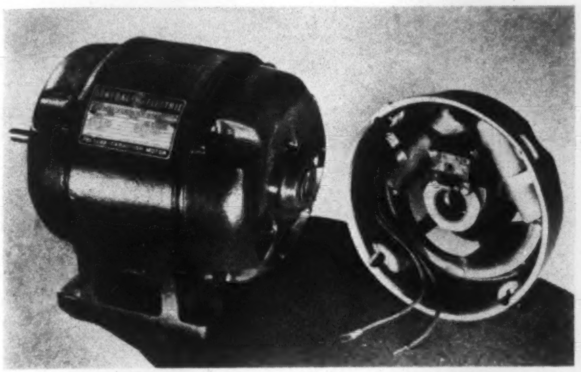
TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. . . . . Toledo, Ohio

necting tubing between the instrument and the bulb.—The Bristol Co., Waterbury, Conn.

Capacitor Motor

No. 2084—As an extension of a recently announced line of new polyphase induction motors, a new "Tri-Clad" capacitor motor designed to meet a large number of varied industrial applications is offered. Like the polyphase motor, it features modern appearance, better mechanical and electrical protection, and protection against operating wear and tear, the maker states.



The new capacitor motor may be obtained with either ball bearing or sleeve bearing construction, and is available in two types. The "Type KC" is designed particularly for applications requiring moderate starting torques such as fans, blowers and centrifugal pumps. The "Type KCJ" is designed for compressors, loaded conveyors, reciprocating pumps, and any other applications requiring high starting torque. The capacitors are mounted inside the end shield on the normal torque motor, while on the high starting torque motor (1½ hp and larger) the capacitors are mounted in a compact case on top of the motor frame.

In both of its forms, this motor incorporates complete mechanical protection through the use of a cast iron frame, electric protection made possible by the use of "Formex" wire in the magnet coils, and improved bearing design and lubricating arrangements. It also utilizes the cast aluminum rotor and double end ventilation. In addition, it offers many convenience features.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Hose for Fumes and Dust

No. 2085—In line with the continually increasing movement for greater safety and increased hygienic conditions for industrial workers, a new line of specially constructed rubber exhaust hose for conducting fumes and abrasive dust has been announced. It is light and flexible, and is easily bent at short angles so that it may be easily located right at the machine or spot from which the fumes and dust may originate, the maker states.

The hose is manufactured in sizes ranging from 2 to 12 in. in diameter, in 8, 15 and 25 ft lengths.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Ammonia Compressor

No. 2086—Principal difference between the new, high speed "V/W" ammonia compressor for industrial refrigeration and the maker's "Freon-12 V/W" compressor is its water jacketed heads, due to higher head tempera-

MATERIALS, MEN, METHODS...all three contribute to INSULATION EFFICIENCY

The above photograph shows New York City's Criminal Courts and Prison Building, now rapidly nearing completion. Designed and constructed under the supervision of the Department of Public Works, Irving V. A. Huie, Commissioner. This building promises to be one of the most outstanding and impressive structures in the city.

Three Ruberoid Insulation products were used on this job: Ruberoid Woolfelt—Air Cell Insulation—85% Magnesia Pipe Covering. Associate Architects, Harvey Wiley Corbett and Charles B. Meyers, New York. General Contractors, Cauldwell-Wingate Co., New York. Ruberoid Approved Insulation Contractors, Magnesia-Asbestos Insulation Company, Inc., New York. Plumbing Contractors, Jarcho Brothers, Inc., New York.

RU-BER-OID SUPPLIES ALL THREE!

Again Ruberoid Insulation products have been used in another outstanding building. This time, New York City's new Criminal Courts Building and Prison. Here again three factors—materials, men, methods—contributed to the insulation efficiency. On every job, Ruberoid offers you all three.

Materials. The Ruberoid line of insulation is complete. It includes pipe coverings and blocks for temperatures from 350° to 1600°F; Woolfelt pipe covering for hot or cold water conduits; asbestos papers for wrapping furnace pipes, protecting air conditioning; specialties such as high temperature cements, millboard, roll board, rock wool bats and blankets.

Men. Throughout the country Ruberoid has Approved Applicators—organizations known and respected for their knowledge of insulation and careful workmanship. These applicators are hand-picked, able, well-qualified to serve you. They are of the highest type in the industry.

Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

Get All Three. On the next job get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for Ruberoid's latest Insulation Catalog. Invaluable as a reference guide. Address The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Dept. HPC-4.

RU-BER-OID Insulation

Reg. U.S. Pat. Off.

For HEATING · COOLING · AIR CONDITIONING

WE'RE BROADCASTING THE FACTS!

The American Broadcasting Company, New York, has selected the flush Aerofuse Supply and Return Unit in their fine air conditioned studios. They appreciate the unobtrusive beauty of this outlet but their real reason for selecting it is its quiet operation and functional superiority. It furnishes ideal air distribution and quick temperature equalization and at the same time is capable of handling air return volume up to as much as 60% of supply air.

AEROFUSE OUTLET

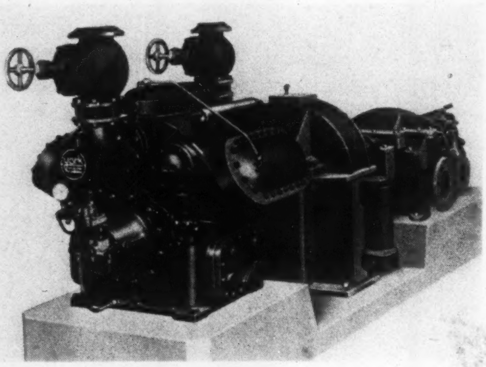
AT LEFT: The Supply and Return Unit. Supply and return ducts lead to the same outlet for simplification of duct work.

AT RIGHT: The Standard Aerofuse Outlet for perfect air distribution without drafts.

T & B

TUTTLE & BAILEY, Inc.
NEW BRITAIN, CONN.
NEW YORK CHICAGO PHILADELPHIA

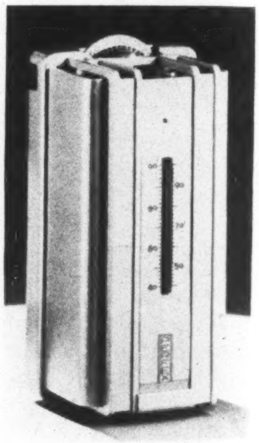
tures. There are also a few slight changes in the selection of metals used internally. The other features of the "Freon" machine have been retained in the ammonia machine. Vibration and noise have been cut to a minimum by static and dynamic balancing; heavy foundations have been eliminated; wearing parts are replaceable; packless, springless "balanseal" and double tapered roller bearings are used; low head room and little floor space are required; and all parts are easily accessible, according to the manufacturer. The machine can be mounted in spots usually avoided by refrigerating engineers—roofs, extra storage rooms, etc.—it is stated.



The high speeds (720 to 1050 rpm) at which the compressor operates permit it to be virtually direct connected to a steam turbine through a simple gear drive. Thus, even a small refrigerating unit can be operated on low pressure exhaust steam.—York Ice Machinery Corp., Roosevelt Ave., York, Pa.

Thermostat for Unit Heaters

No. 2087—A new addition to the "Twin Contact" line of controls is a heavy duty line voltage thermostat specifically designed for the control of unit heaters.



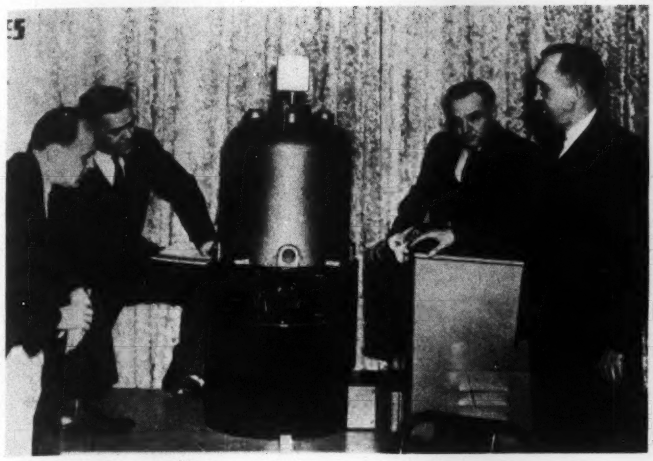
When used for heating, this device may be set to control at any desired temperature from 40 to 80 F. For ventilating purposes, an "on" position beyond the 80 F mark produces continuous fan operation. A safety latch prevents accidental turning of the temperature dial to the "on" position.

A special bellows thermal element, operating through a spring-hinge linkage opens and closes the electrical circuit.—Perfex Corp., 500 W. Oklahoma Ave., Milwaukee, Wis.

Stoker Fired Water Heater

No. 2088—The new "Freeman" stoker fired water heater has been developed for use in apartments, beauty parlors, barber shops, hotels, restaurants, residences and other places where an abundant supply of hot water is needed. It is designed for stoker firing with the manufacturer's new "T-1" stoker, has fins in the combustion chamber walls to increase capacity, and features sturdy construction, the maker states.

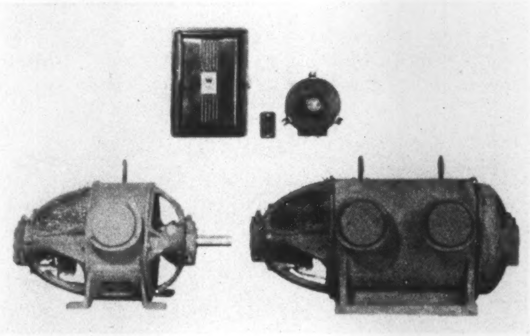
According to the manufacturer, this unit can also be



used as an automatic heating plant for filling stations, small stores, etc.—Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.

Adjustable Speed Drive

No. 2089—Designed especially for industrial applications requiring smoothly adjustable speeds over wide ranges with constant torque, in locations where only a-c supply is available, a new 10 to 1 adjustable speed drive, which uses a series circuit without the usual exciter, has been announced. It is available in ratings from 1 to 15 hp with a standard speed range of from 175 to 1750 rpm, for two or three phase operation on 220, 440, 550 volt, 60 cycle systems.



The drive has five parts, including control: (1) a single unit motor generator set, consisting of a squirrel cage induction motor driving a series d-c generator which supplies operating voltage for (2) a d-c series motor coupled to the driven load. In parallel with the generator series field is (3) a rheostat which controls the driving motor speed. Control apparatus consists of (4) an across the line starter for the squirrel cage motor, and (5) a pushbutton station.

Among its applications are coal feeders and stokers.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Tight Press Fit for Bearings

No. 2090—A novel method has been developed for heating bearing cones preparatory to assembling them on shafts where a tight press fit is required.

This device consists of three trays about 4 ft square, approximately 12 in. above each other. The middle tray is of "pyrex" glass while the top and bottom trays each carry seven 250 watt special infra-red ray bulbs. The reflectors on these special bulbs are gold plated.

SOUND ISOLATION IS A "CINCH" WITH THIS ILG BLOWER!
BC-4.5 UNIVERSAL BLOWER
ILG ELECTRIC VENTILATING CO.
CHICAGO, U.S.A.

Patented "FLOATED DRIVE"

Rides in Rubber!

LOW COST—Instead of expensive, cumbersome, time-consuming sound-isolation of blower and motor bases, ILG Direct-Connected Blowers can be provided (at slight additional cost) with the exclusive, patented "Floated Drive" Bracket when extra sound-and-vibration dampening is required.

SIMPLE—With "Floated Drive", the ILG Motor and Wheel are isolated, *as a unit,* without affecting the position of the wheel in the housing. *They ride in rubber!* And, experience in the field proves that this outstanding sound dampening arrangement is more effective—it provides isolation *at the point of sound origin!*

PHONE OR WRITE TODAY!

"Floated Drive" is but one of many features available only on ILG Blowers to reduce installation time and expense, practically eliminate servicing, assure customer satisfaction. Get the whole story in Catalog EB-381—call our nearest branch office or write us today for your copy!

ILG
BLOWERS

ILG ELECTRIC VENTILATING CO.
2841 N. CRAWFORD AVENUE, CHICAGO, ILLINOIS
Offices in 43 Principal Cities

ILG

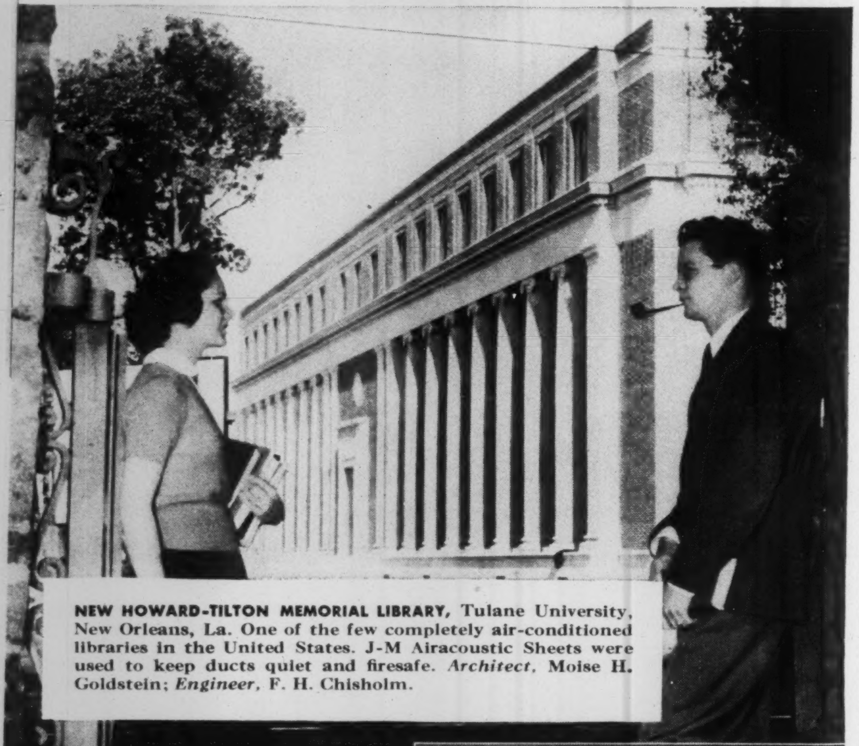
Vitalized★
VENTILATION
AND AIR CONDITIONING
★AIR CHANGE...NOT JUST AIR MOVEMENT!

COMFORTABLE...

Thanks to complete air conditioning

QUIET...

Thanks to duct linings of J-M Airacoustic Sheets



NEW HOWARD-TILTON MEMORIAL LIBRARY, Tulane University, New Orleans, La. One of the few completely air-conditioned libraries in the United States. J-M Airacoustic Sheets were used to keep ducts quiet and firesafe. *Architect*, Moise H. Goldstein; *Engineer*, F. H. Chisholm.

LARGE, LIGHT-WEIGHT UNITS make Airacoustic Sheets easy to handle. Installation is fast and economical.

There's no possibility of noise in air-conditioning ducts disturbing users of this new Tulane University library. Quiet was assured by specifying J-M Airacoustic Sheets for duct linings.

This mineral lining material absorbs more than 70% of all noise in the ducts. Even more, it makes systems safer, for it will not support flame . . . effectively resists the spread of fire. And, because Airacoustic Sheets are highly resistant to moisture, they provide unusual protection against humidity.

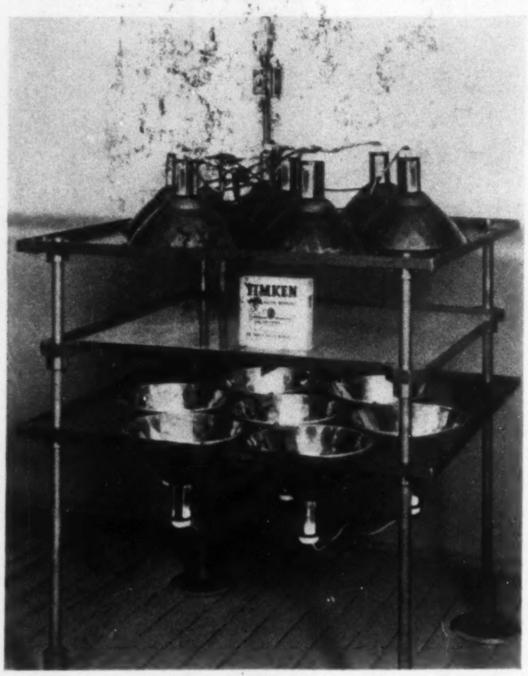
Why not include duct quieting in every estimate? A check-up will show you that J-M Airacoustic Sheets cost so little installed that any customer can afford their extra protection.

For complete details, write for brochure AC-23A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

JM Johns-Manville

AIRACOUSTIC SHEETS FOR DUCT LININGS

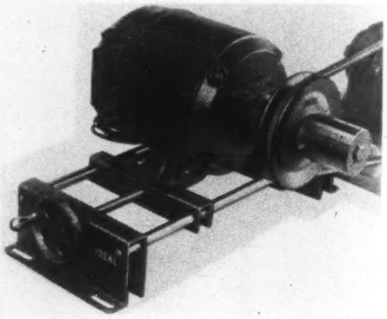
Bearing cones are not taken out of the boxes, but are stacked in their containers. About 20 min is required to heat a bearing up to a maximum of 155 F. The infrared rays penetrate the boxes and heat the steel.



When this method of heating is used, it is not necessary to wash off the protective coating which is put on the bearings at the time of packing.—Timken Roller Bearing Co., 1835 Dueber Ave., S. W., Canton, Ohio.

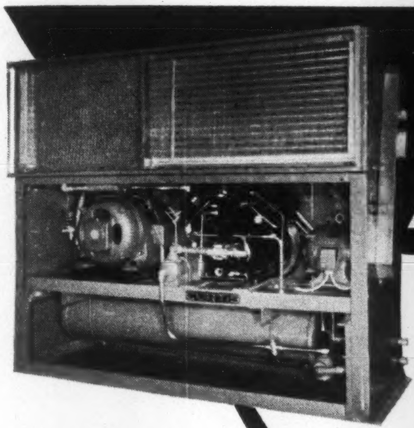
Variable Speed Pulley

No. 2091—A new variable speed pulley which mounts directly on the motor shaft and requires only standard v belts is designed for light machinery. It may be had in sizes up to ¾ hp and speed ratios up to 2¾ to 1 are available.



Features include, according to the manufacturer, short over-hang, forced lubrication, a balanced sheave and all metal construction. The complete unit includes the variable pitch pulley and an adjustable sliding motor base. By turning the handwheel of the base, the motor moves backward or forward to decrease or increase belt tension. This causes the pulley to open or close, changing the pitch diameter and the driven speed. —Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.

For your convenience in obtaining more information about any of this equipment, see coupon on page 122. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed



CURTIS Packaged Air Conditioners

Built to Sell and to Stay Sold!

They sell because the Curtis line of Packaged Air Conditioners is complete including models ranging from 3 to 15 tons capacity, designed to meet the requirements of practically every type of retail and business establishment in every community

They stay sold because they are engineered and built to give complete satisfaction to the user. Your customers and prospects will want Curtis for these and many other reasons:

(Above) 7½, 10, *and 15 ton Central Type Air Conditioner*

(At Right) 3 *and 5 ton Packaged Type Air Conditioner*

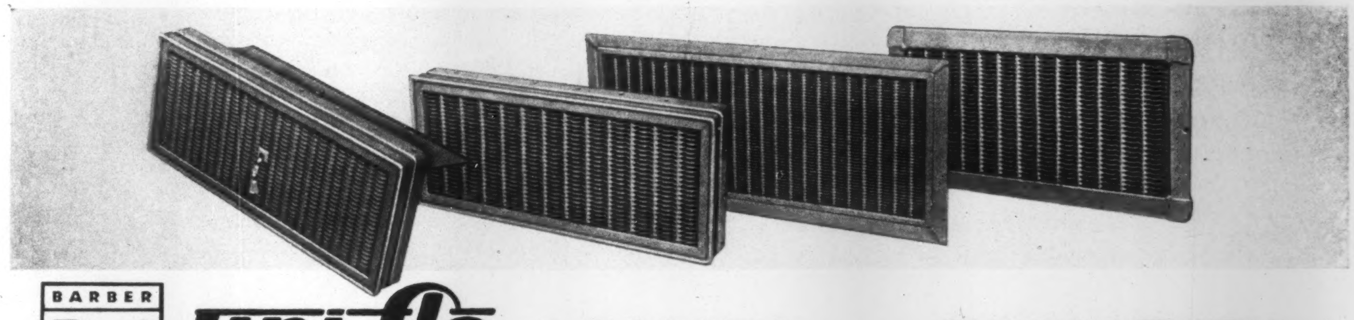
Curtis Packaged Air Conditioners

- Cool, dehumidify, circulate and filter the air
- Are attractive in appearance—blend with store fixtures
- Can be quickly and easily installed — often in one day
- Precision built for efficient, economical, trouble-free performance
- Easily financed
- Adaptable for heating, if desired

You, too, can cash in on this fast growing market, a source of sales and profits for progressive dealers everywhere. It will pay you well to write today for information on the complete Curtis line.

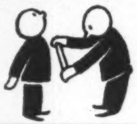
CURTIS REFRIGERATION
AIR CONDITIONING AND COMMERCIAL

Curtis Refrigerating Machine Company
Division of Curtis Manufacturing Co. — Established 1854
1950 Kienlen Ave. St. Louis, Mo.



BARBER B-C COLMAN

UNI-FLO GRILLES AND REGISTERS ARE TAILORED TO YOUR REQUIREMENTS...



WHAT "ENGINEERED AIR DISTRIBUTION" MEANS...

Barber-Colman engineers use data based on an elaborate series of laboratory tests to specify the size and fin arrangement of each grille individually, taking into consideration all the specified conditions, and thus providing a pre-planned set of Grilles and Registers which can be guaranteed to give the desired performance.

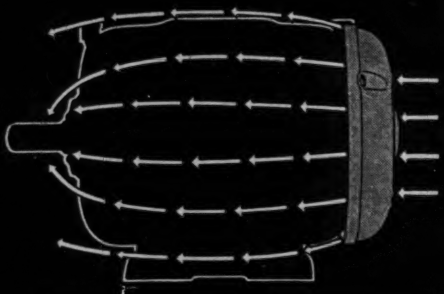
● UNI-FLO gives you ENGINEERED AIR DISTRIBUTION, specifically planned for the particular building in which the installation is to be made. Each job receives individual engineering attention, insuring that all conditions will be adequately met. In this way, every UNI-FLO job is "tailored" to fit exactly the existing requirements. Furthermore, UNI-FLO installations are backed by a *guarantee of satisfactory performance* which assures the user of correct air distribution.

UNI-FLO
GRILLES AND REGISTERS

WRITE FOR THIS NEW CATALOG
It contains full descriptions and illustrations of all UNI-FLO Grilles, Registers, and Accessory Items.

1228 ROCK ST. **BARBER-COLMAN COMPANY** ROCKFORD, ILL.

NEWEST DESIGN
Cool-running
MOTOR



Illustrating forced air movement over entire exterior of motor frame.

It's the BALDOR . . .
Streamcooled MOTOR

Totally enclosed motor with outer-mounted fan which drives a continual stream of cool air over exterior of motor providing a dependable, NON-CLOGGING cooling system. The result: better performance and longer life for the motor.

Many other features explained in BALDOR Bulletin No. 202. Ask for it.

BALDOR ELECTRIC COMPANY, ST. LOUIS
Representatives in Principal Cities

BALDOR
BETTER MOTORS

Book Reviews

Applied Heat Transmission

[Applied Heat Transmission, by Herman J. Stoever, associate professor of mechanical engineering, Iowa State College. 1st ed. 1941. 226 + vii pp., 6 x 9 in., clothbound. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y. Price, $2.50.]

This book is suitable both as a text, and as a reference for the practicing engineer. Because of its arrangement of material, the many tables and charts, and the numerous illustrative examples, it provides the engineer who solves heat transfer problems only occasionally with the needed data in readily accessible and understandable form.

The entire field of heat transfer is not treated, forced convection being the subject principally dealt with. Those who have problems in forced convection—such as the flow of air and water over tubes, and problems involving heat transfer from steam to oil—will find sufficient data for readily solving their problems.

In addition to treating forced convection fully, there is also an excellent chapter on computation of pressure drop through heat exchange equipment. This is of importance to the practicing engineer. Satisfactory pressure data applicable to the types of equipment with which the practicing engineer deals are difficult to find.

The emphasis throughout this book is on practical applications rather than on theory. Mathematical derivations are avoided. Instead, the equations are presented in simple form, and numerous tables and charts make the solution of these equations a matter of simple arithmetic. Illustrative examples throughout clearly show how the data are to be applied.

Fuels and Their Utilization

[Fuels and Their Utilization, by A. R. Carr, dean of the college of engineering, Wayne University, and C. W. Selheimer, assistant professor of chemical engineering, Wayne University. 1st ed. 1940. 180 pp., 6 x 9 in., clothbound. Published by Pitman Publishing Corp., 2 W. 45th St., New York, N. Y. Price, $2.00.]

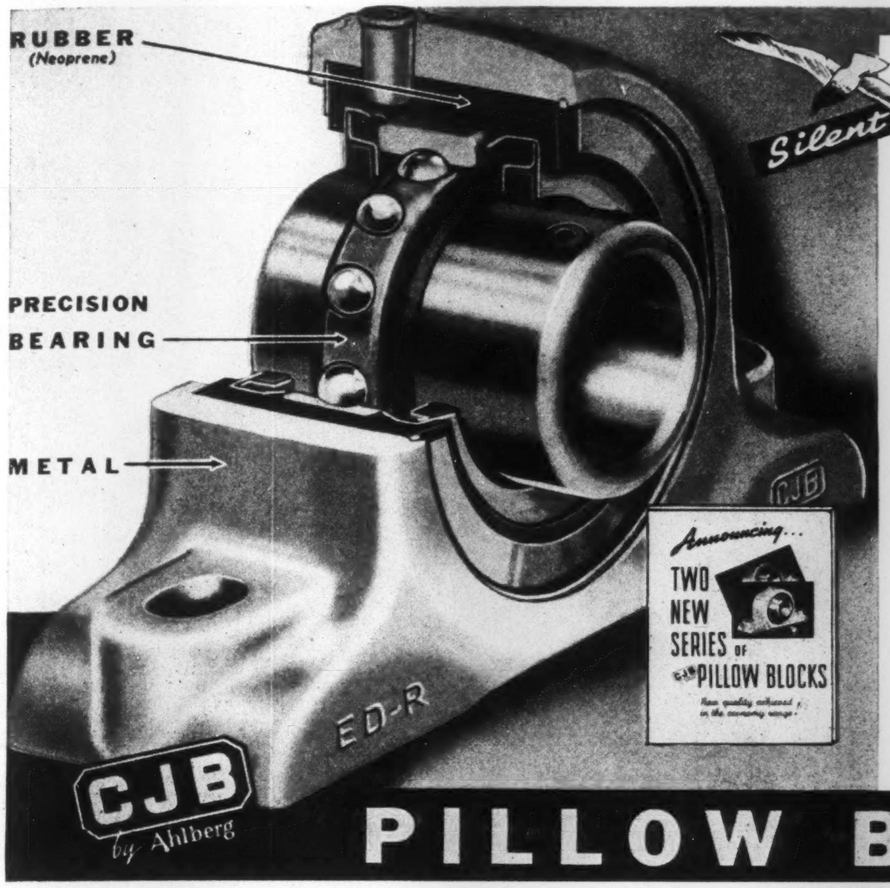
This book is limited strictly to the scope indicated by its title—fuels and their proper utilization to produce heat. No attempt is made to discuss the subject of thermodynamics, nor to cover the subject of how the heat is utilized after steam has been produced.

There are chapters on combustion, on the classification of gaseous, liquid and solid fuels, manufactured fuels, combustion of coal and other solid fuels, waste heat and its elimination, calorimetry determination of heat input, heat balances, temperature measurements, water for industrial purposes, and a section giving in detail 17 laboratory experiments, with instructions on equipment, materials, references, procedure, etc.

General Engineering Handbook

[General Engineering Handbook, Charles E. O'Rourke, professor of structural engineering, Cornell University, editor-in-chief. 2nd ed. 1940. 1120 + xi pp., 5½ x 8 in., semi-flexible binding. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York, N. Y. Price. $4.00.]

The primary purpose of this book is to present in one



RUBBER
(Neoprene)
Insulated

This sound-insulated ball bearing pillow block, developed by Ahlberg, provides silent anti-friction efficiency. It is the ideal light duty bearing for air-conditioning equipment, fans, furnace blowers, etc.

Its precision, quiet-running CJB bearing is completely cushioned from the all-metal housing with Neoprene, newest synthetic rubber, which is impervious to oil. Frictionless, labyrinth-type seals, also of Neoprene, provide real protection for the bearing.

Silence is the word on this new pillow block. Cost is very reasonable. Write for the Bulletin (shown at left) for complete details and prices.

AHLBERG
BEARING COMPANY
Manufacturers of CJB Master Ball Bearings
3041 WEST 47TH STREET, CHICAGO, ILLINOIS

PILLOW BLOCKS

for *better* air conditioning performance . . .

Waterloo
AIR DIFFUSION EQUIPMENT

You can just about measure the performance of an air conditioning job by the quality of the diffusion equipment that is used. That is why so many engineers and contractors are specifying Waterloo Units to control the direction, volume and diffusion of air at each outlet. Correct use of Waterloo Air Diffusion Equipment offers the best possible guarantee against unbalanced distribution which means drafts and discomfort. Write for new catalog containing illustrations, charts and installation data. ● Waterloo Register Company, Waterloo, Iowa, and Seattle, Wash. Representatives in principal cities.

volume the important fundamental data relating to all branches of engineering. Since its object is not to replace more extensive works in specialized fields, some of the more highly specialized sections of the first edition have been omitted, and the basic sections have been expanded. Among the important fundamental sections which have been rewritten entirely and enlarged are those on mathematics, materials, mechanics and hydraulics.

The book is divided into the following sections: mathematics; mathematical tables; physical tables, engineering materials; theoretical mechanics; hydraulics; structural theory and design; plain and reinforced concrete; foundations; topographic and geodetic surveying; route surveying and earthwork; highways; municipal sanitation; machine elements; pumps, compressors, and hydraulic turbines; engineering thermodynamics; heating and air conditioning; fundamentals of electrical engineering; and electrical measurements.

Supplement to Book of ASTM Standards

[ASTM Standards 1940 Supplement (Part I, Metals; Part II, Non-Metallic Materials—Constructional; Part III, Non-Metallic Materials—General). 1940. 479, 349 and 575 pp., respectively, 6 x 9 in., clothbound to match ASTM Book of Standards (half leather binding available for $1.00 per part additional). Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Prices, $3.00 for any one part, $5.00 for any two parts and $7.00 for all three parts.]

To keep up to date its triennially published Book of Standards, the American Society for Testing Materials in the two intervening years issues supplements to each part of the book. The 1940 supplement, recently issue in three parts, gives in their latest approved form 29 specifications, tests and definitions which were either issued for the first time in 1940 or revised.

Part I on metals, with 100 standards, includes 48 specifications covering ferrous metals—iron castings, steel, etc.; 49 specifications pertaining to the non-ferrous field—aluminum and aluminum alloys, magnesium and magnesium alloys, copper and copper alloy castings, and lead and lead alloys; and three general testing methods.

Part II includes 91 standards covering the non-metallic materials used for constructional purposes. Specifications and tests cover cement, gypsum, refractories, glass, concrete and concrete aggregates, etc.

Part III, the largest volume, covers the following materials: coal and coke, petroleum products and lubricants, electrical insulating materials, plastics, rubber products, textile materials, paper, etc.

A sheet of stickers is furnished with each of these supplements for pasting in the corresponding 1939 Book of Standards to call attention to changes and standards which are obsolete.

Fire Protection Handbook

[Crosby-Fisk-Forster Handbook of Fire Protection, Robert S. Moulton, technical secretary, NFPA, general editor. 9th ed. 1941. 1308 + xxiv pp., 4½ x 6½ in., semi-flexible binding. Published by National Fire Protection Association, 60 Batterymarch St., Boston, Mass. Price, $4.50.]

Of interest to almost all engineers is the new ninth edition of this handbook of fire protection. Examples

ADSCO - BANNON CONDUIT
TILE CONDUIT FOR UNDERGROUND LINES

(Below) Insulated steam lines in place and ready for top of conduit and backfilling.

(Below) Completed conduit installation ready for backfilling operation.

(Above) Bottom half of conduit and base drain with pipe supports and saddle plates ready for steam pipe installation.

REASONABLE IN COST—
EASY TO INSTALL

PROMPT SHIPMENTS, USUALLY FROM STOCK

ADSCO-Bannon Tile Conduit for underground steam and hot water lines is a strong, vitrified product available with or without base drain in sizes from 4-24" inclusive. In combination with ADSCO "Fiberglas" Filler Insulation, it is very reasonable in cost, easily installed with a minimum of field engineering and makes a permanent installation of high thermal efficiency. Most orders can be shipped promptly from ample stocks or shortly after receipt of order at the tile factory.

Send details of installation for quotation or write for Bulletin No. 35-67HP.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

of sections of the handbook which are completely new are detailed information concerning the hazards and fire protection of air conditioning systems, an entire chapter relating to mine fires and explosions, quantities of material about special extinguishing systems, and many other items.

In addition, each chapter of the handbook has undergone numerous revisions and changes since the eighth edition of five years ago. Notable among the changes are the table of properties of flammable gases and solids, which has been thoroughly revised; the chapter dealing with electricity, which now contains a considerable amount of new information including the fire hazards of static charges; several chapters relating to automatic sprinkler protection; and all sections of the book which deal with either public or private fire protection. Naturally, all statistics including tables, charts, and diagrams have been brought up-to-date.

The book represents the work of more than 100 authorities in the various branches of the fire and allied professions, who have put their knowledge and experience at the disposal of the publisher.

Useful Information

Condensation in Walls

Moisture Condensation in Building Walls is the subject of Report BMS63, issued under the general title of Building Materials and Structures by the National Bureau of Standards. Copies of the 16 p. booklet are available from the Superintendent of Documents, Washington, D. C., for 10c.

The report was prepared by Harold W. Woolley as a result of numerous requests for information on moisture condensation in insulated walls. The conditions under which moisture condensation will occur are discussed in a general way to make available to architects, builders and others information concerning the factors which control humidity in walls. These factors are presented so as to make possible estimates of the probability of moisture condensation in walls, assuming the construction details and moisture conditions inside and outside the building are known.

Apartment Building Costs

Chicago apartment owners spend 17½c out of every dollar of building income to keep their tenants warm and almost 10c out of every dollar to keep them pleased with their surroundings, according to H. Lowell Baker, head of the Chicago Real Estate Board committee which has published a 12 p. survey of apartment operating costs for the entire city. This comprehensive analysis of apartment operating costs provides a yardstick for apartment building operation which will give building owners and property managers a basis for checking their operating costs, according to Mr. Baker. The figures cover more than 322 apartment buildings, containing 5874 home units, made up of 29,521 rooms.

Decorating, fuel and janitor service, in the order named, are the three most expensive items. Decorating

THE MARK OF SUCCESSFUL
AIR CONDITIONING

Illustrated above is the Supreme Court Room, Department of Justice Building, Raleigh, N. C. — Northup & O'Brien, Architects, Winston-Salem, N. C. Lighting Fixtures in combination with ANEMOSTAT Draftless Air Diffuser designed and manufactured by Benson Manufacturing Co., Kansas City, Missouri.

ANEMOSTAT
Draftless AIR DIFFUSERS

The answer to successful air conditioning is **correct air distribution.** ANEMOSTATS on duct outlets assure correct air distribution by **equalizing temperatures and humidity,** and **eliminating drafts.** As a result, completely comfortable conditions are maintained and operating costs are reduced. That is why ANEMOSTATS are familiar fixtures in all types of buildings, where air conditioning at its best is demanded. ANEMOSTATS are easily installed and may be applied to existing systems as well as new installations.

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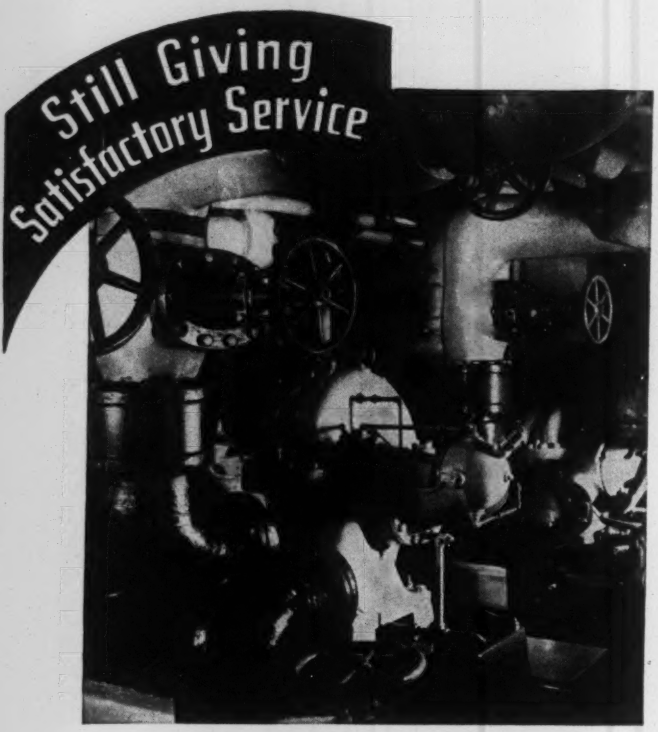
"NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION



Fairbanks Iron Valves on House Service Pumps, Hotel New Yorker, New York.

Valves, like other equipment in hotels, must give service 24 hours a day, 7 days a week.

To assure dependable control of the water service for the 2500 rooms in the Hotel New Yorker, New York, Fairbanks Valves were installed throughout the entire plumbing system.

At a recent interview Mr. W. D. Lewis, Chief Engineer, stated that their Fairbanks Valves have cost practically nothing for upkeep during the many years they have been in service and that no repair parts have been required.

Fairbanks Valves are made in globe, gate, angle, check and cross patterns for a large range of pressures . . . in metals best suited for the service desired.

Our engineers are, at all times, ready to assist in solving difficult valve problems without cost to you.

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Standard and Renewable **Valves**

takes almost 10 per cent of the gross income of the average apartment building each year, while janitor service and fuel run 17.52c of every dollar collected by the apartment building; 8.96c of this goes for fuel, 8.56c to the janitor.

Interesting items found in the survey were time factors for replacement of various appliances and furnishings in the building. The average life of an oil burner, for instance, was found to be 11½ yr, and a stoker 12 yr.

Items in the tabulation are set up in three classifications: cost per room per year of maintaining the apartment; percentage per room per year of the total income of the building; and the cost per cubic foot of maintaining the apartment. Several pages of explanation and additional information are included in the survey, which is available from the Chicago Real Estate Board, 32 W. Randolph St., Chicago, Ill., for $3.00.

Analysis of Industrial Waters

Committee D-19 on water for industrial uses of the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., has issued a tentative method of reporting results of analyses of industrial waters, ASTM designation D596-40T. Copies of this standard are available at 25c each from ASTM headquarters.

This standard method has been under development in the committee for some time. It presents recommendations as to the nature, extent and form in which the results of analysis of industrial waters should be presented, and includes definitions, conversion factors and other data.

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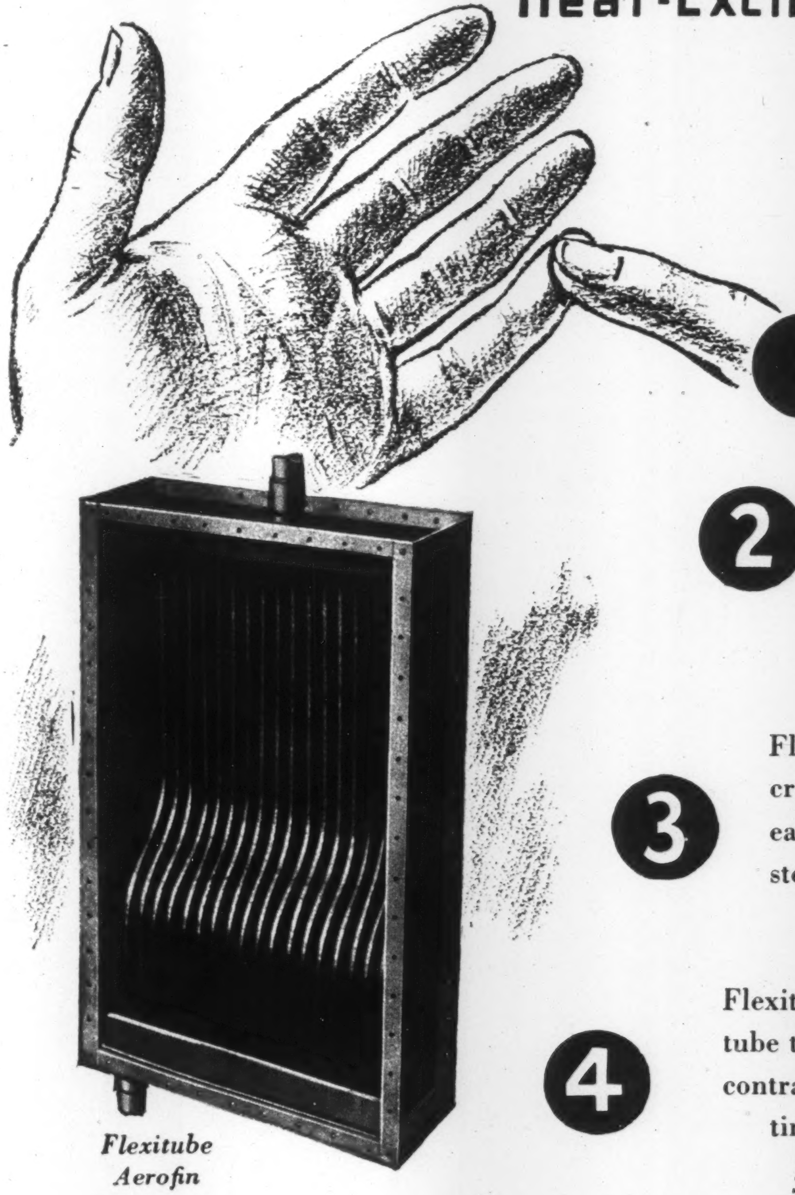

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① Flexitube Aerofin has a core which is completely non-ferrous, having copper tubes and cast bronze headers.

② Flexitube Aerofin has patented joints between tubes and headers which are brazed at 1200° F., the resulting bond being stronger than the tube itself.

③ Flexitube Aerofin has a patented crown type orifice in steam end of each tube, which assures adequate steam supply at all times and prevents clogging of the tube inlet by scale.

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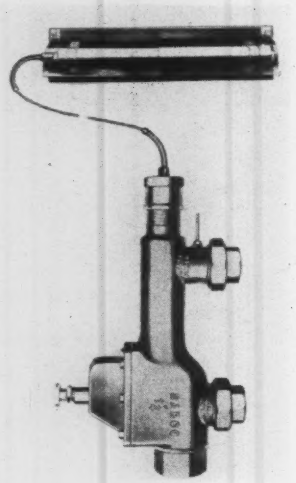
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Control for Hot Water Heating

No. 2092—A new weather control for hot water heating—known as the "Sarcotherm"—has been developed to provide a fully automatic system which, by mechanical means, is designed to assure, the manufacturer says, uniform room temperatures under all weather conditions, a smaller temperature difference from ceiling to floor to result in less heat loss, substantial savings in first cost by utilizing high water temperatures during periods of extreme weather conditions and thus to permit smaller pipe sizes, and fuel savings by preventing overheating in mild weather.



The control consists of a thermostatic three way valve adapted to recirculate to the system a varying portion of the returned water, adding automatically the right proportion of hot water from the boiler to maintain correct radiator temperatures. A liquid expansion thermostat is mounted on an outside wall of the building (usually with a northwest exposure) and pressure built up in this thermostat, when it absorbs heat, is transmitted through flexible connecting tubing to the valve operator. The position of the mixing valve is determined by the combined influence of outside temperature and that of the mixed water.—Sarco Co., Inc., 475 Fifth Ave., New York, N. Y.

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [5-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2092	2093	2094	2095	2096	2097	2098	2099	2100	2101
2102	2103	2104	2105	2106	2107	2108	2109	2110	2111
2112	2113	2114	2115						
3855	3856	3857	3858	3859	3860	3861	3862	3863	3864
3865	3866	3867	3868	3869	3870	3871	3872	3873	3874
3875	3876	3877	3878	3879	3880	3881	3882	3883	3884
3885									

Name ....Title...................

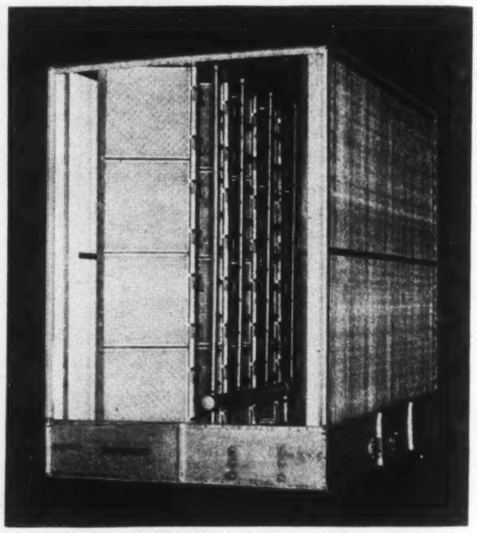
Company ....

Address ....

City ....State...................

Filter-Washers

No. 2093—A new filter-washer designed for efficient humidifying and evaporative cooling, has recently been announced and offers the following features, according to the manufacturer:



High cleaning capacity is accomplished by spraying liquid against the bank of filters, which is set vertically in position to offer minimum resistance to air flow. The filter pads are continually flushed with liquid sprays and the collected material is washed into the sump tank. It is stated that the standard units will approach saturation when recirculating but 2½ gpm of water per 1000 cfm of air at 700 fpm velocity, and that under these conditions the scrubber and eliminator plates effectively remove entrained moisture from the leaving air. The filter pads are mineral wool or glass fiber units.

In areas where there is a greater than 20 deg spread between the entering dry bulb and entering wet bulb temperatures of the air, the manufacturer states it is necessary to use a greater water quantity and a type of nozzle that sprays both with and against the entering air. For such conditions, the special design illustrated here is used. It incorporates a single bank of double spray nozzles together with entering eliminators and inspection door.

These units are available in a complete range of sizes of nominal dimensions running from 3x3 to 22x10 ft for capacities from 6300 to 154,000 cfm.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

"Freon" Compressors

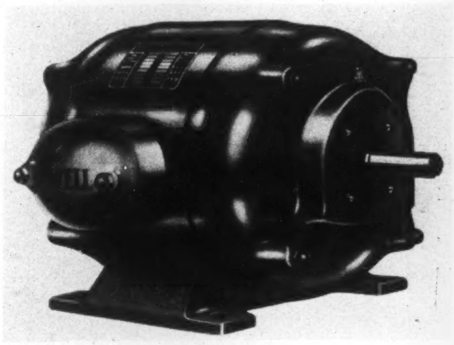
No. 2094—A new line of refrigerating machines designed for use with "Freon-12" on air conditioning work for food service, process plants, marine jobs, and similar installations, has been announced. They are known by the trade name "Eclipse"—which was used on the manufacturer's equipment many years ago—and are built in three sizes.

Capacities range up to 60 tons of refrigeration in a single machine. It is stated that distinctive features of the design include safety cylinder heads, forced feed lubrication from a submerged oil pump, an extra large oil screen, a combination capacity control and automatic unloader, and outside type "Flexo-Seal" at the shaft.

The standard drive is through V belts, but engine type squirrel cage motors are installed directly on the shaft when desired.—Frick Co., Waynesboro, Pa.

Protected Motors

No. 2095—A new line of protected motors of the open type, designed to provide complete protection against dripping liquids, metal chips or other falling particles, was recently announced. According to the manufacturer, the motor frame is non-breakable and is fabricated from heavy steel plate; the laminations are first riveted together, then pressed into the frame and then made permanent by electric welding. The base is of malleable iron securely attached to the frame.

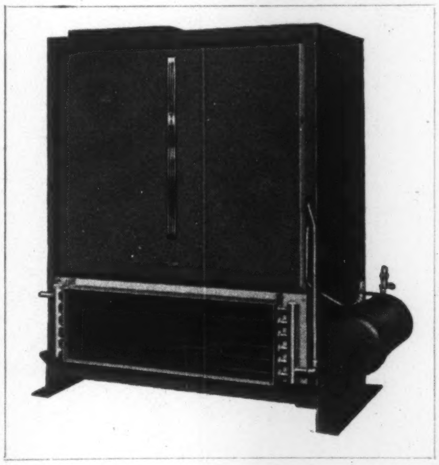


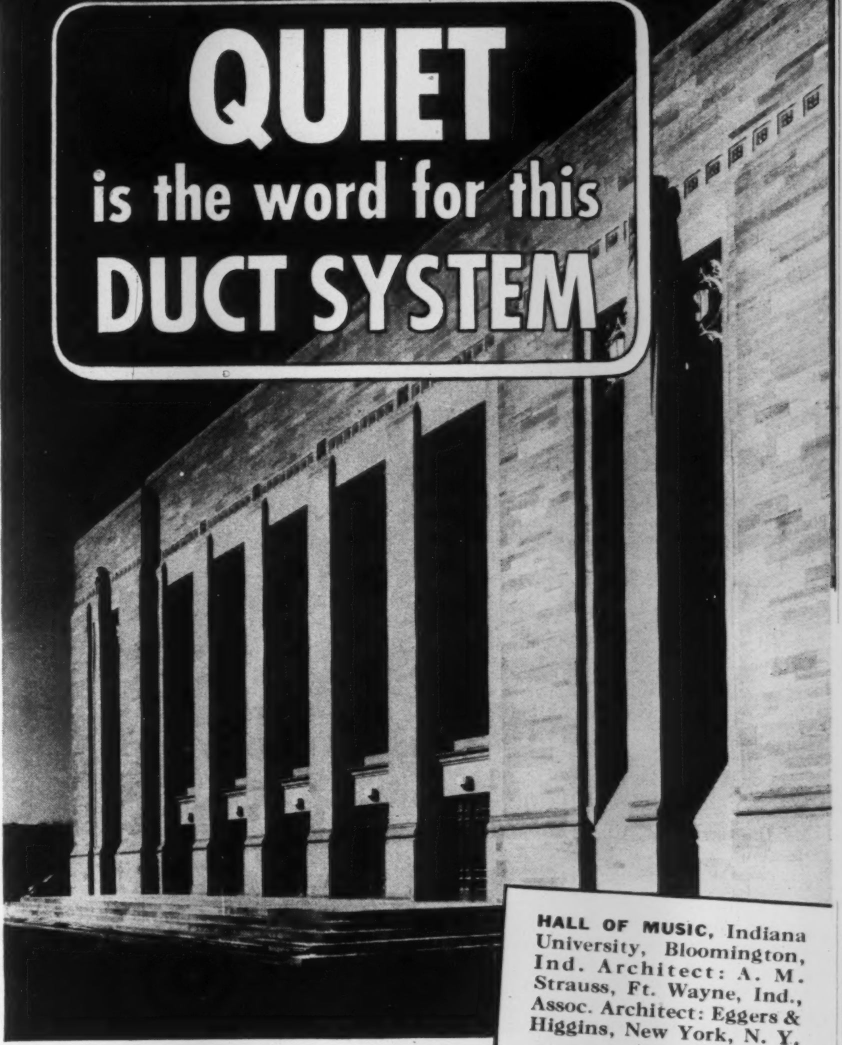
The end plates are high grade cast iron, accurately machined and diamond bored for the bearings. Each end plate has but one opening for ventilation, well below the center line and protected on top and sides. The ventilating fan is extra large and these motors are rated at 40 deg Centigrade rise.

Of modern "streamline" design, the motors are available in integral sizes up to 5 hp and larger sizes are to be available later.—Howell Electric Motors Co., Howell, Mich.

Saturated Air Condensers

No. 2096—Illustrated is one of a new line of saturated air condensers of the evaporative type which have been designed to provide an economical means of condensing vapors and are particularly adapted for use in localities having high water rates, where ordinances restrict the use of water, and where increased water demands have outgrown the water mains and sewers. According to the manufacturer, these units are com-





QUIET
is the word for this
DUCT SYSTEM

HALL OF MUSIC, Indiana University, Bloomington, Ind. Architect: A. M. Strauss, Ft. Wayne, Ind., Assoc. Architect: Eggers & Higgins, New York, N. Y.

• • •

EASY TO HANDLE, J-M Airacoustic Sheets are quickly installed at low cost.

J-M Airacoustic Sheets eliminate noise in air-conditioning ducts in Indiana University's new Hall of Music

REALIZING that noisy air-conditioning ducts can seriously interfere with proper hearing, architects for this beautiful auditorium eliminated any such possibility by lining all ducts with J-M Airacoustic Sheets.

Unusually sound-absorbent, this mineral duct lining soaks up 70% of all sounds that strike it . . . is ideal for quieting air-conditioning ducts in schools, restaurants, offices and commercial buildings. It will not flame . . . fire hazard is reduced. And its high moisture resistance provides exceptional protection against humidity.

Airacoustic comes in large, light, easily handled sheets . . . is so economical and easy to install you can include it in every estimate. For full details, write for brochure AC-23A. Johns-Manville, 22 E. 40th St., New York, N.Y.

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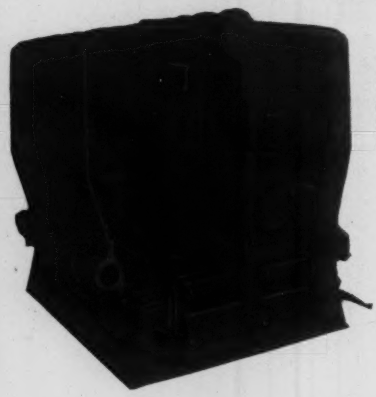
AIRACOUSTIC SHEETS FOR DUCT LININGS



CAPACITIES
Ratings to 29,200 sq. ft. for steam. 46,720 sq. ft. for water.

—For Quick Delivery—
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For Defense
Hurry Up Orders

ANY part of this twin section cast iron 50-inch grate boiler, can be slid thru the usual sized door.

No tearing out of building necessary for installation.

No tackle needed.

Base is in sections.

Grates are twins.

Does not require a deep set foundation.

Used extensively for heating of manufacturing plants where cost of keeping power boiler steam up, for off-working-hours is not economical.

Can ship promptly.

Full details gladly furnished.

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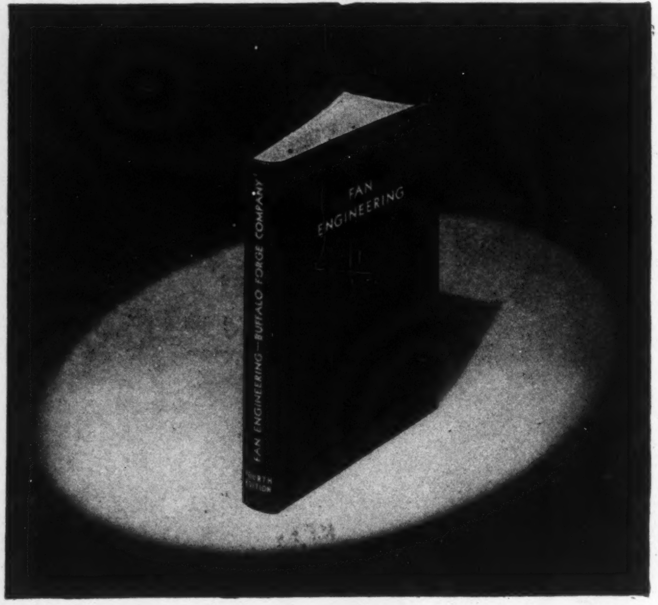
The "AIR" Handbook



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pact and will fit into places where head room is at a minimum. They use less than 3 gph of water per ton under normal conditions They may be installed either inside or outdoors.

These saturated air condensers represent a combination of an air cooled condenser and an evaporative condenser, and the water will shut off when outside air temperature is low enough to condense efficiently. The condenser coils can be split into two sections to permit operation for two compressors on one condenser.—Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.

Smoke Detector

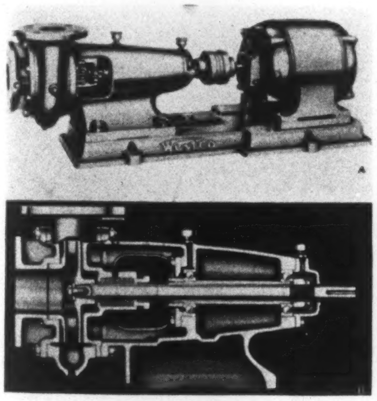
No. 2097**—A new smoke detector for the automatic safety control of air conditioning and ventilating systems comprises an electronic unit to be attached to an air duct to detect the passage of smoke and stop the ventilating fan. Special features include a visible operating indicator and a dust-tight lens that can be easily removed, cleaned and replaced without stopping the ventilating equipment or entering the duct.

This indicator can be used not only to stop the ventilating equipment when smoke passes through the duct, but can be interconnected with the damper control devices to close all dampers and block the smoke from entering the building.

According to the manufacturer, the equipment supervises itself and is adjustable to any smoke density.—Worner Products Corp., 1019 W. Lake St., Chicago, Ill.

Centrifugal Pumps

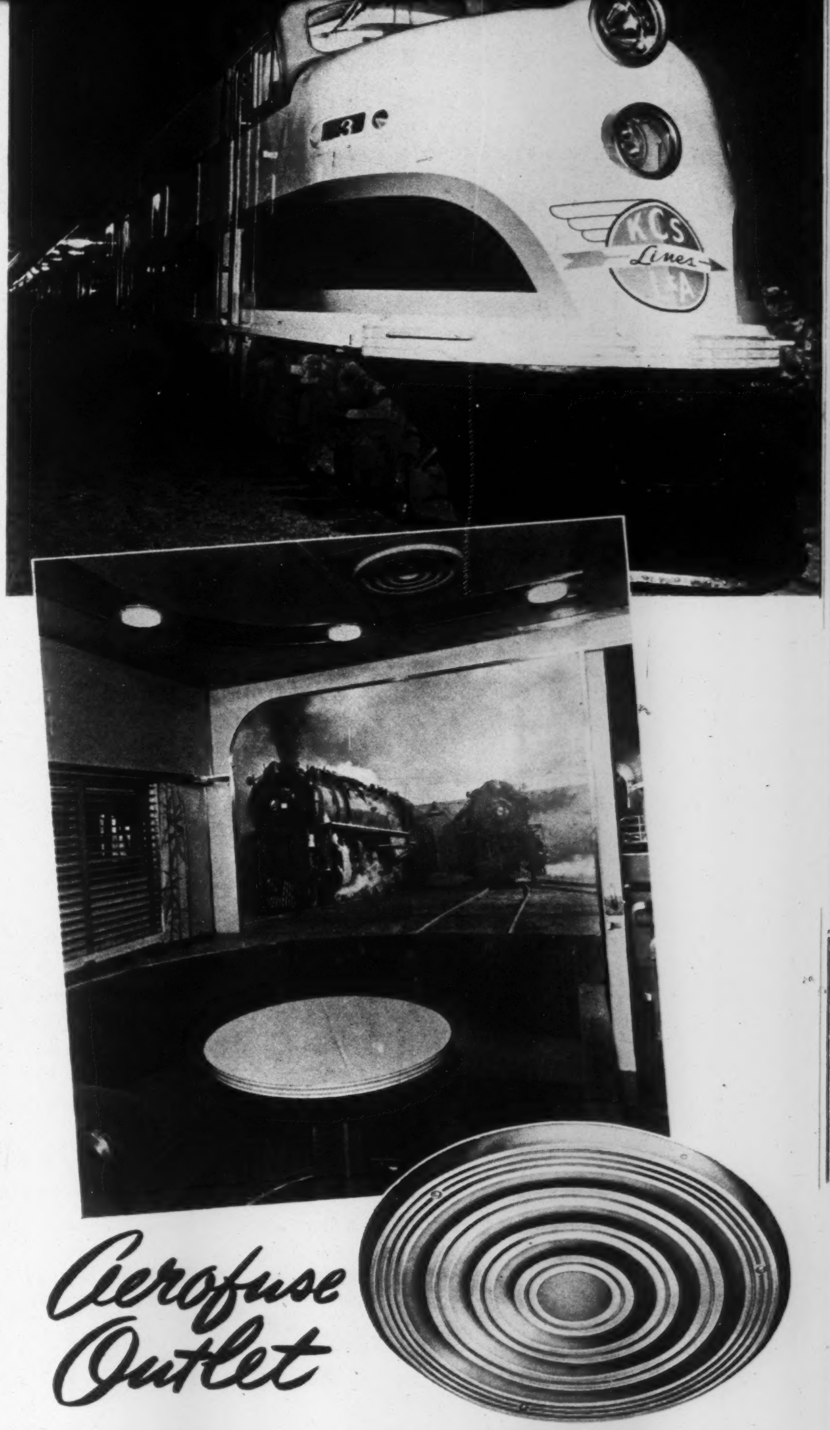
No. 2098—The new line of "Westco" side suction centrifugal pumps includes flexible coupling drive models in sizes 1¼ to 6 in., inclusive, and "Uni-Bilt" models in sizes 1¼ to 4 in. They are offered by a manufacturer who has been concerned mainly heretofore with the promotion of turbine type pumps.



General construction is of heavy close grained cast iron with a "torpedo type" frame for absorbing operating strain and guarding against misalignment. Two oversize ball bearings on the flexible coupling drive models are completely enclosed and have flush type lubrication.

The enclosed or semi-open impellers are hydraulically and mechanically balanced to insure quiet operation. The enclosed style, recommended for handling clear liquids, has triple-faced wearing surface and can be adjusted to compensate for wear. Semi-open, non-clog impellers are recommended for liquids containing foreign material in suspension.

The volute shell is of scientific design to provide a smooth streamline channel flow, the maker states. The discharge can be installed in four positions without re-



RIDES THE RAILS

In an America streamlined for efficiency, this fleet Diesel powered iron horse is naturally taking its rightful place to revitalize our transportation system. Here you will find the Aerofuse Outlet on the job. This scientifically built air diffuser is flush to the ceiling — unobtrusively attractive. First and foremost an *efficient* unit, it provides maximum air mixture, quick temperature equalization, perfect air distribution and total elimination of drafts.

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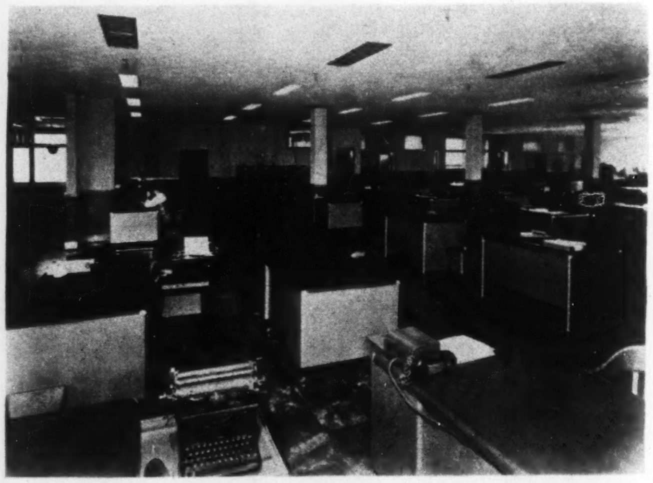
THE ALL-ASBESTOS INSULATED DUCT
for AIR-CONDITIONING SYSTEMS

CAREYDUCT is made entirely of asbestos—combines both duct and insulation. Simple slip-joint construction and standardized parts make fitting on job easy and rapid. Cuts easily with saw; no shop work necessary.

CAREYDUCT "hushes" fan noises; reduces "speaking tube" effects. Air velocities may be increased without noise, enabling you to use smaller sizes—a saving in both materials cost and labor.

CAREYDUCT is fireproof; can't rust or rot. Makes a smoother, better-looking, more efficient job. Size for size, it costs LESS than insulated metal duct.

Bring your duct work up-to-date—keep customers satisfied—make more money—with CAREYDUCT. Write today for full details—address Dept. 25.



CAREYDUCT was used in the air-conditioning system installed in the plant and modern office addition of The Burkhart Mfg. Co., St. Louis. The duct conveys cool air in summer; warm air in winter. Due to the fact that CAREYDUCT "hushes" noise, the Burkhart offices are among the quietest in that city.

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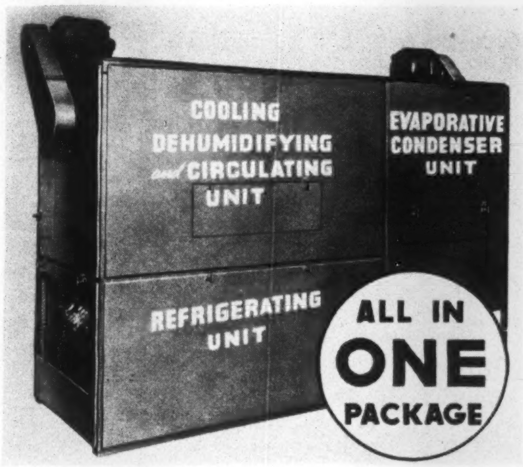
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD. Office and Factory: LENNOXVILLE, P. Q.

ducing accessibility of the stuffing box.—Micro-Westco, Inc., Bettendorf Office Bldg., Bettendorf, Iowa.

Theater Air Conditioning

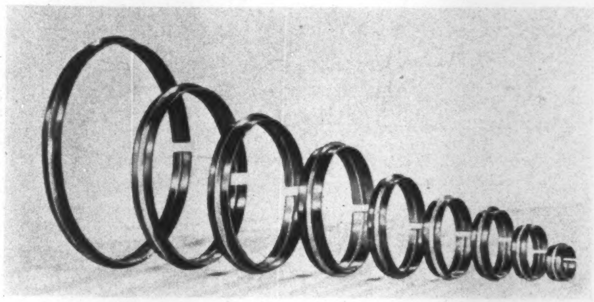
No. 2099—The air conditioning unit illustrated—known as the "Refrigerated Kooler-aire"—has been developed specifically for theater air conditioning and comprises a refrigeration compressor; an air cooling, dehumidifying and circulating unit; and an evaporative condenser unit. According to the manufacturer, every necessary device for efficient operation and automatic control of the system is self-contained within the one housing, and comes to the job completely equipped and ready to operate as soon as the electrical and control connections, the duct connections and the water connections are made. A complete unit of 20 ton cooling capacity requires less than 4x9 ft of floor space. Six models are available with compressor motor horsepowers of 5, 7½, 10, 15, 20 and 25 hp.


COOLING
DEHUMIDIFYING and CIRCULATING UNIT
EVAPORATIVE CONDENSER UNIT
REFRIGERATING UNIT
ALL IN ONE PACKAGE

Possible arrangements include a single unit ceiling distributing system with the duct in the center of the theater, a two unit side wall distributing system with a duct at each side of the theater, and single and two unit proscenium distributing systems.—U. S. Air Conditioning Corp., 2101 Kennedy St., N.E., Minneapolis, Minn.

Welding Rings

No. 2100—A new line of welding rings for lining up and spacing pipe are so designed that they can be used with all types of the manufacturer's welding fittings and with straight pipe. Scientifically designed, they assure a perfect, full strength joint and practically eliminate the human element hazard in welding, the maker states. The operator applies sufficient heat to melt and puddle the



SURE, I'LL CONFESS! THIS ILG CONTROLLER SOLD THAT JONES JOB FOR ME!

"SIMPLE AS A-B-C—when Jones saw this Ilg Variable Air Controller, then compared quotations, the job was ours. He said that this simple bank of vanes built like a shutter on the discharge side and manually controlled with this quadrant handle was the slickest air control he'd ever seen.

"JUST LIKE A WATER CONTROL VALVE—on a centrifugal water pump driven by a constant speed motor, was what I told him. He could easily understand that!

"ELIMINATES CUMBERSOME BELTS—and expensive slip ring motors—and man, did Jones go for that! Especially when I showed him that our efficiencies are much higher under conditions of reduced air volume.

"CUTS DOWN OPERATING COST—because the power required to drive the blower drops off with the reduction in air delivery. He started pushing his pencil around when I showed him our Brake Horsepower Curve.

"CAN BE ELECTRICALLY OPERATED, TOO!—by means of a small motor operated by a conveniently located remote push button station. While Jones didn't need remote control, it's a good thing to know."

And it's a good thing for you to know ALL the features of Ilg Blowers! Get the facts now—write or phone for Catalog EB-381 today!

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VENTILATION
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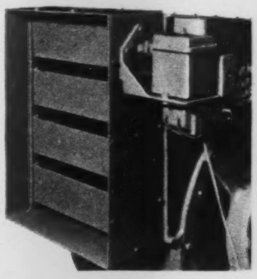
*AIR CHANGE...NOT JUST AIR MOVEMENT!

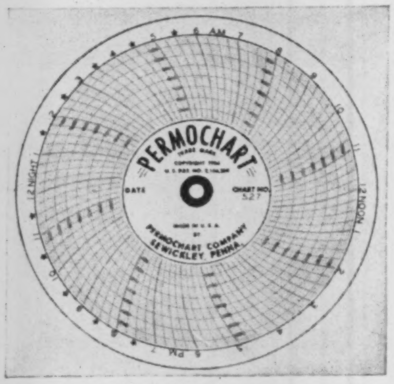


ridge of the ring, thus getting full penetration to the bottom of the pipe wall without slag or icicles.

Besides speeding up the actual welding process in both arc and gas methods, they simplify the lining up in that no clamps, guides or fixtures of any kind are needed for supporting pipe and fittings for tack welding, it is stated.—Tube-Turns, Inc., 238 E. Broadway, Louisville, Ky.

Recording Instrument Charts

No. 2101—Made of vinylite plastic, the improved "Permochart" recording instrument chart can be constantly re-used, as the previous day's ink record is easily removed from its surface with a damp cloth. The charts will not curl, are non-flammable, and are oil, gasoline and grease resistant, the maker states. Chart centers are reinforced to prevent deterioration, and printing and laminating have been improved so that the charts are clearer and to prevent separation at the edges.



For applications where it is necessary to save chart records, a microfilm photographic system for recording and filing has been established. According to the manufacturer, this method reduces filing space by 98 per cent. —Permochart Co., 461 Chestnut Rd., Sewickley, Pa.

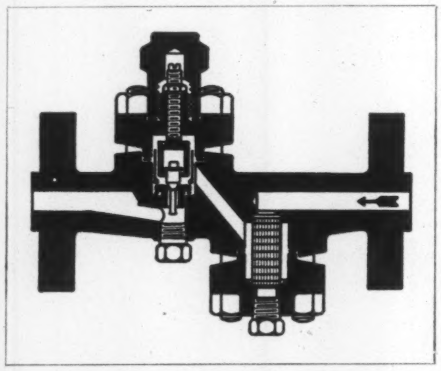
Explosionproof Motor

No. 2102—Approved by the Underwriters' Laboratories for Class II, Group G atmospheres (explosive grain dust) a new totally enclosed fan cooled motor protects against explosions of grain dust in suspension, the maker states.

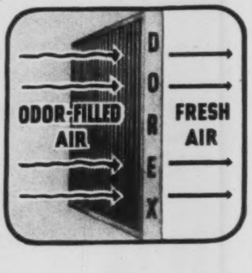
The cooling air is forced through the large air passages surrounding the motor closure at a velocity which resists clogging and keeps the air passages clean.—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Superpressure Steam Trap

No. 2103—The "Yarway" impulse steam trap is now available in a superpressure type for high pressure, high temperature trapping service in steam power plants. It is of high pressure, flanged end (or welding socket end), bolted bonnet design, with integral strainer. The working parts are similar to



TAKE THE GUESSWORK OUT OF RECIRCULATION



Introducing fresh air, cooling it in the summer, warming it in the winter—that's elementary. But when it comes to determining how much air can be *recirculated* without becoming foul or odorous—that's where the guesswork comes in. There is, however, a foolproof way to recirculate a maximum of air with the assurance that odors injurious alike to business and employee health will be removed, and the added assurance that operating costs of the conditioning plant will be low. That's where Dorex Odor Adsorbers come in and guesswork goes out.

Only sufficient outside air to cover oxygen requirements is needed when Dorex is installed, because odors are eliminated from the remainder when it passes through the highly activated Dorex coconut shell carbon. The reduction in outdoor air supply is an *important* factor in economical air conditioning operation and represents a dollars and cents saving to your customers. And remember, on *new* air conditioning installations, the maximum permissible recirculation will be the *governing* factor in determining the size and cost of the system.

Take the guesswork out of recirculation with Dorex. This positive method of odor control has a vital meaning to air conditioning.

"WORKS LIKE A GAS MASK"
DOREX
Reg. U. S. Pat. Off.
ODOR ADSORBERS

THERE IS A SPECIAL DOREX unit for almost every industrial or commercial odor problem, and smaller sizes for independent use—

HOSPITALS OFFICES FACTORIES
RESTAURANTS THEATERS HOMES
STORES COLD STORAGE COMPANIES
LABORATORIES LOCKER PLANTS

Bulletin H-5, *What Dorex Odor Adsorbers Mean to Air Conditioning,* brief and concise, contains facts and figures. From it you can determine almost at a glance just how much Dorex will save on any given job, regardless of size. Write for your copy today

DOREX
DOREX

DOREX DIVISION
W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street • *New York, N. Y.*
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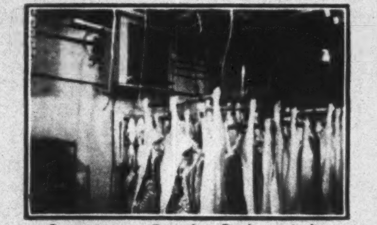
In Canada: Arthur S. Leitch Co., Ltd., Toronto

FOR ODOR-CONTROL, AIR CONDITIONING AND VENTILATION

DEPENDABLE VALVES

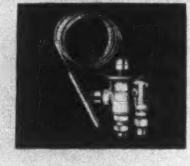
Offer RESPONSIBILITY . .

in MEAT PROTECTION



One room at Brandon Packers, Ltd., showing Unit cooler with No. 205 A-P Thermostatic Expansion Valve.

New Refrigeration Plant of "The Brandon Packers, Ltd.," Brandon, Manitoba, Canada.



A-P Model 205 Thermostatic Expansion Valves. 16 of these Valves and 2 Model 210 Valves were used at Brandon.

The new Refrigeration Plant of Brandon Packers Limited uses . . .

☆ "A total of sixteen A-P Valves, and all doing a fine job"—according to the Winnipeg Refrigerator Parts Company, Winnipeg, Canada, who sold the Valves to Marshall Wells Company for installation by Ace Service Station at Brandon, Canada.

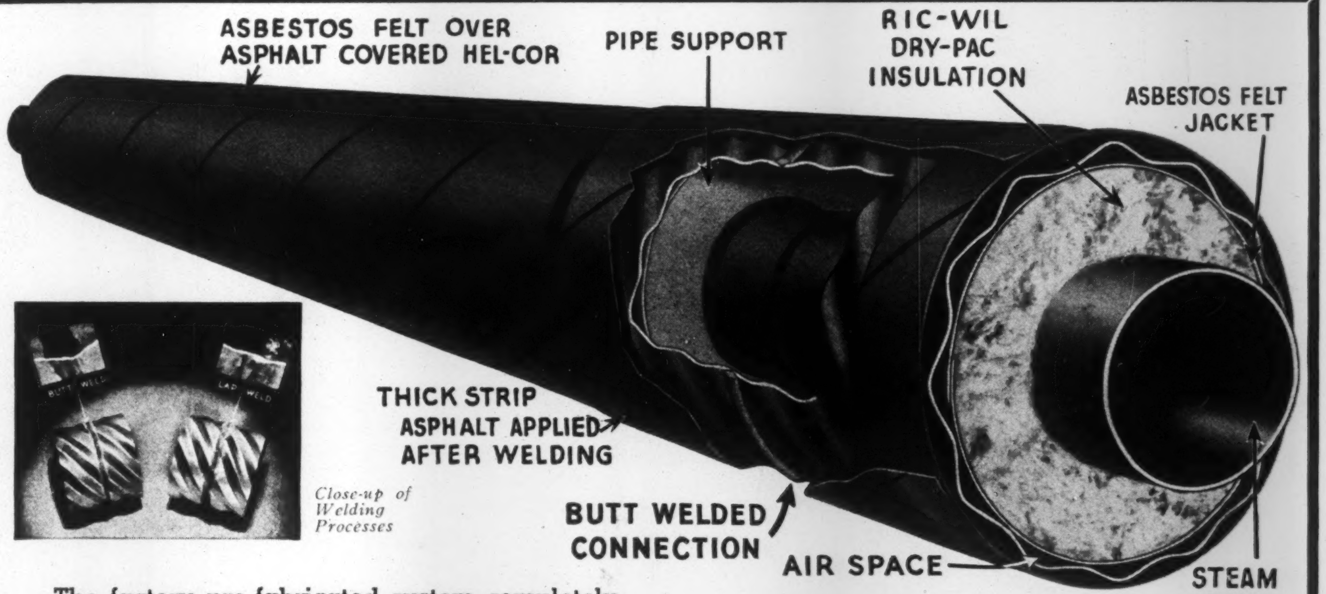
☆ Like the majority of leading Jobbers the world over, Winnipeg Refrigerator Parts Company have good reason for recommending and selling A-P DEPENDABLE Valves. A letter recently from Mr. James Gibson, Manager, outlined some of these reasons —

☆ "It is approximately four years since we began stocking A-P Products, and to say we are satisfied in every way with them is putting it rather mildly . . . We get further satisfaction from passing these same products over the counter to our customers, knowing that they are assured of DEPENDABLE operation with them."

☆ This is a reputation you can use to profit—the A-P reputation for DEPENDABILITY and "Responsible" Refrigerant Control. Try it on your next job.

Progressive Service Engineers use and recommend — Aggressive Jobbers stock and talk— AP Products.

AUTOMATIC PRODUCTS COMPANY
2460 NORTH THIRTY-SECOND STREET
MILWAUKEE WISCONSIN


ASBESTOS FELT OVER ASPHALT COVERED HEL-COR
PIPE SUPPORT
RIC-WIL DRY-PAC INSULATION
ASBESTOS FELT JACKET
BUTT WELD
LAP WELD
THICK STRIP ASPHALT APPLIED AFTER WELDING
BUTT WELDED CONNECTION
AIR SPACE
STEAM PIPE

Close-up of Welding Processes

The factory pre-fabricated system completely engineered and shipped assembled as shown, for modern requirements on underground distribution of steam, hot water, and oil • High thermal efficiency, long life, low installation cost • Design, fabrication, and installation planned and supervised by engineering specialists • Units furnished in lengths to fit the job • Conduit shell is helical corrugated Armco Pure Ingot Iron, with lock seam heavily asphalt coated and wrapped • Units are joined by split coupling or by welding • Prompt shipment—speedy installation—nothing else to buy • On YOUR next job, specify R. I. P. • Full details on request.

THE RIC-WIL CO., Cleveland, O.
Agents in Principal Cities

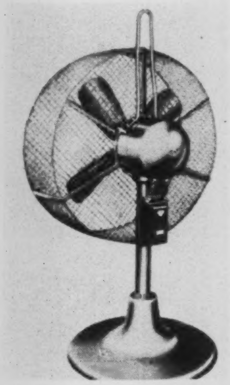
RIC-WIL PRE-SEALED INSULATED PIPE UNITS

those in the standard impulse trap in which opening and closing of the valve (the only moving part) is governed by changes in pressure in the control chamber above the valve piston. Medium temperature condensate reduces the chamber pressure and the valve opens; high temperature condensate increases the pressure and valve closes.

The superpressure trap is built for steam pressures up to 1500 lb and temperatures to 900 F. Pulsating or varying pressures will not interfere with the operation, it is stated.—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Man Cooling Fans

No. 2104—A new 36 in. heavy duty portable floor fan, especially valuable for "man cooling" use, can be placed anywhere and affords a practical and economical means of relief to workmen in areas of intense heat, according to the manufacturer. A 90 ft blast of air cuts right through hot spots, closely confined departments, and hot air pockets, it is stated.



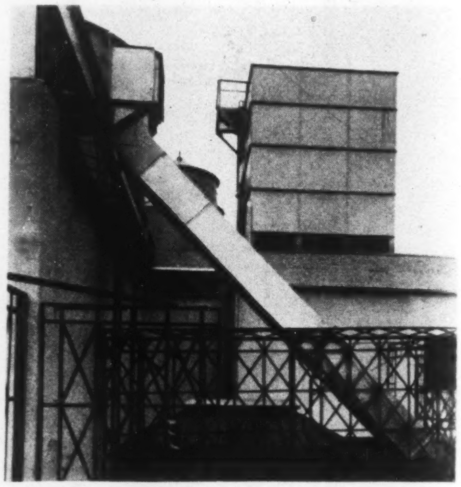
The fan is equipped with a cast iron base of extra heavy construction, has a low center of balance, and can be safely moved on a scoop truck. A hook is provided for moving it by crane.

The propeller is of the four blade type, of one piece metal construction keyed to the motor shaft. There are heavy steel mesh guards over the fan.

Other models—not of extra heavy construction—are available in 36, 30, 24 and 12 in. sizes.—Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Cooling Towers

No. 2105—Illustrated here is a cooling tower designed for a New York store in such a way as to insure minimum noise and maximum life, according to the manufacturer. It is of the induced draft type. The fan is driven through a worm gear and the motor is placed on a platform to keep it out of the humid air stream.



As the tower is situated next to the store's recreation roof, spray loss had to be eliminated. This was accomplished through the use of special wooden eliminators.

The water is distributed through upshoot spray nozzles

Distinctive Advantages Announced for the new

Eclipse

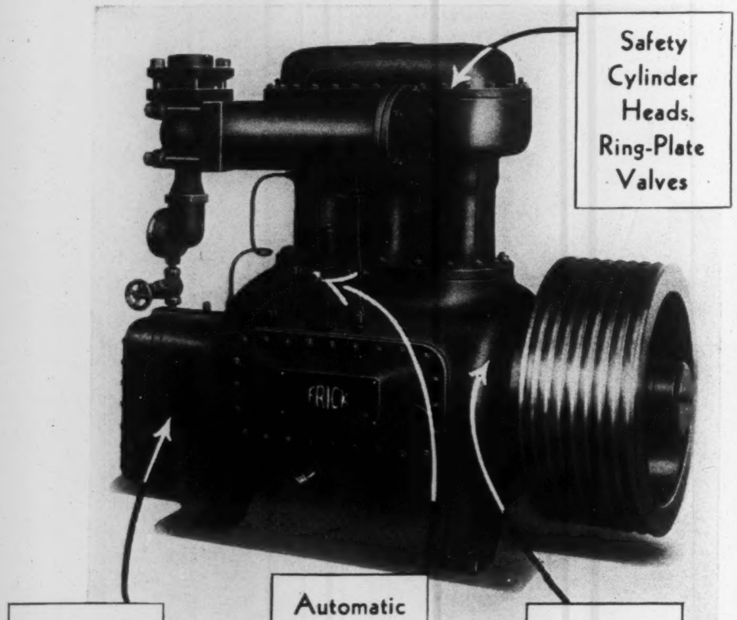
Refrigerating Machines

Don't buy ANY Freon-12 compressor until you've seen the new Frick Eclipse line! Built in three sizes, these phenomenal machines give capacities up to 60 tons refrigeration . . . in units so compact, light, efficient, and quiet they can be installed almost anywhere . . . and at a material saving over older types!

Only in the Eclipse line can you get all the exclusive advantages shown, plus such features as higher operating speeds (up to 900 r.p.m.), force-feed lubrication throughout, direct-connected motor drive when desired, two machines operating together (using the Frick oil-equalizing system), pistons with 5 rings, etc., etc. Nearly 60 years' refrigerating experience built into them.

Write, wire or phone your Frick Branch or Distributor for full details today. Or, get in touch with

DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.


Safety Cylinder Heads. Ring-Plate Valves
FRICK
Submerged Oil Pump Oversized Oil Filter
Automatic Capacity Control and Unloader
Patented Flexo-Seal at Shaft

that dissipate a large proportion of the heat before the water comes in contact with the wooden filling—the theory being that the water drops themselves are exposed on all sides to the cooling air, whereas a water film on the wooden filling is exposed only to the air on one side.

While the use of bronze sprays for distribution is more expensive than the use of wooden troughs, such a spray operation permits of a reduction in the amount of filling, which in turn means a reduction in internal resistance in the tower and therefore more air from a given fan at a given horsepower, according to the maker. Another advantage is accessibility for repainting the inside.—Water Cooling Corp., 71 Nassau St., New York, N. Y.

Butterfly Valve

No. 2106—Illustrated here is a hand wheel operated design of an improved butterfly valve in which internal parts are machined to assist operation and to obtain a tight fit between housing and vane. The line includes a standard range of sizes from 2 to 48 in. for working pressures up to 15 lb.

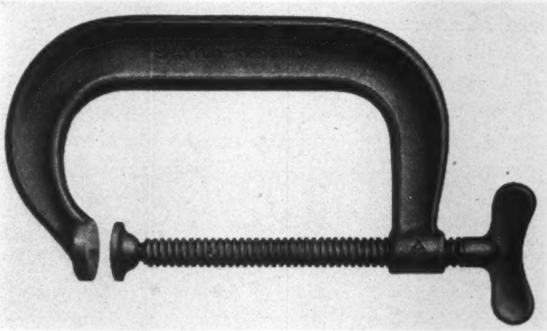
A feature is the pair of adjustable stops which are provided to stop the vane in either of two set positions between open and closed. This permits constant duplication of any set maximum or minimum opening in addition to full open and tight closed positions, according to the manufacturer. All valves have a graduated dial and pointer for the exterior determination of the butterfly vane position.

The hand wheel assembly operates through a self-locking worm and quadrant and is arranged on the side of the housing so the wheel can be located in the most convenient position. Wheels, worm and quadrant can be omitted and a lever connected directly to the butterfly vane shaft for hand lever operation.—R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.

Welding Clamp

No. 2107—A special "spatter resisting" finish on this drop forged C clamp resists the adherence of welding spatter to the body, swivel and screw, according to the manufacturer.

These completely cadmium plated clamps are available in seven sizes, with capacity opening range from 2 to 12 in.—J. H. Williams & Co., 225 Lafayette St., New York, N. Y.



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TO INSULATE DUCTS WITH
DUX-SULATION

Saves 75% of the Heat Loss. K .27 B.T.U.

High Sound Absorption. 70% in less than 10 lineal feet.

Balances job. Saves Fuel. Quiets Noises.

Fire-Safe with Asbestos Protection built in.

Made especially for Air Conditioning, Ventilating and Warm Air Industries.

Prevents Condensation, Duct Sweating, and Duct Rust.

Inexpensive to use. No material waste. Built to last and stand hard usage.

Moisture proof Surface. Mildew proof Treated. No rotting or chipping.

Convenient to handle in stock or on job. Roll contains 100 square feet.

Standard 1/2" thickness is right thickness for most jobs.

Easiest insulation to apply and looks best.

Low frictional resistance. Smooth surface.

Can be applied on inside or outside of round or rectangular ducts.

Comes Complete, ready to apply. No extras to buy.

Free BULLETIN No. 404

YOUR COPY OF THIS VALUABLE BOOK ON CORRECT DUCT INSULATION IS READY.
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GRANT WILSON INC
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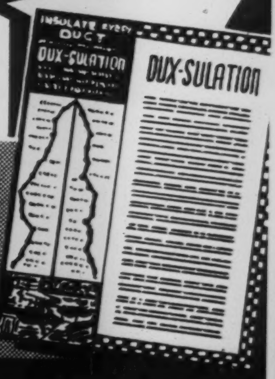
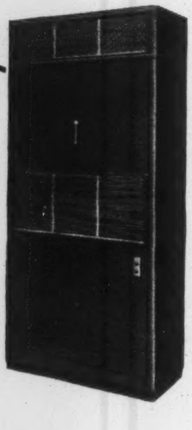


AIR-CONDITIONING PROSPECTS
REFRIGERATION PROSPECTS



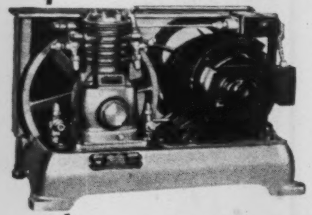
Available in 3 sizes of standardized self-contained units, G-R Packaged Air Conditioning finds a ready market.

A Two Party *Line* that's getting *Results*

Yes, Lipman Automatic Refrigeration and G-R Unit Air Conditioning form a "two-party" line that's keeping our sales and service organization on-the-jump in these days of increased activity. That's why we are looking for increased Sales and Service representation in many desirable territories.

If you are in a position to help us keep pace with the growing demand for these two closely related lines, we urge you to write us at once regarding the possibilities in *your* territory. If you have the qualifications and facilities, this profitable "two-party" line can start ringing the bell for you right from the beginning of the new summer season. Both lines are nationally advertised in leading trade and business publications. Both are backed by one of the oldest names in the field of commercial refrigeration — plus thorough sales and engineering cooperation. Write for details of our profitable dealer arrangement.

GENERAL REFRIGERATION DIVISION
YATES-AMERICAN MACHINE COMPANY
BELOIT, WISCONSIN
DEPT. H. P. A. 541



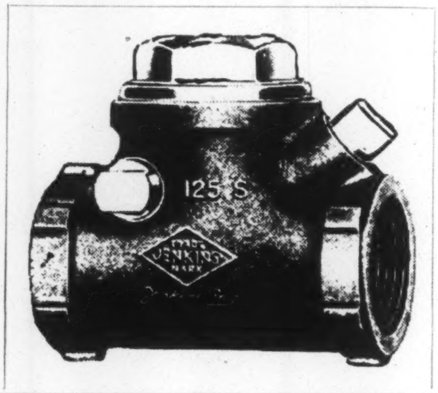
Lipman Refrigerating Units are built in types and sizes for every commercial or industrial need.

Lipman
AUTOMATIC REFRIGERATION
GR
AIR CONDITIONING
CONQUERS HEAT

Lipman
AUTOMATIC REFRIGERATION

Bronze Swing Check Valve

No. 2108—A new regrinding swing check valve, "Figure 92," for 125 lb steam pressure at 500 F or 250 lb non-shock cold oil, water or gas has been announced.



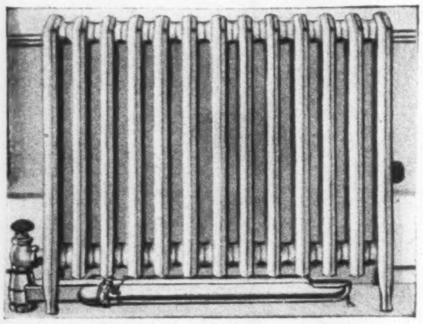
This valve, which according to the maker permits full flow practically equal to that of the pipe, is particularly suited for condensate and return lines as well as for feed and oil line service.

The disc can be reground without removing the valve from the line. The body is liberally proportioned and extra strong. It is provided with ribs in place of the customary hexagon to provide a firm grip for either a Stillson or a monkey wrench.

The valve is made in sizes from ¼ to 2 in. inclusive.—Jenkins Bros., 80 White St., New York, N. Y.

Humidifier

No. 2109—An automatic humidifier, known as the "Warco Moisturator," is designed to be an integral part of the heating system. It may be used on steam, vapor, hot water or warm air heating systems and is generally installed beneath a radiator.



It operates on the principle of evaporating a thin film of water around a copper evaporator heater supplied by steam from the heating system itself or from a special steam generator provided for hot water and warm air systems. A newly designed float valve with a positive control furnishes necessary water for evaporation which is supplied either from the water line or from the radiator condensate.—W. A. Russell & Co., Bridgeport, Conn.

Motor Controllers

No. 2110—For use with polyphase wound rotor motors on fan, pump and similar drives, a new motor operated secondary controller has been announced.

The controller drive mechanism consists of a pilot motor, a gear reduction unit and a "Geneva" gear for angular movement of the cam shaft. Step by step action is assured by a gear and pinion arrangement to move the controller one full position or point for each gear revolution.

Optional features, such as remote position indication, follow-up attachment and time delay operation, can be provided.—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

ECONOMICAL STEAM PRODUCTION

***builds prestige for contractors who install* PETRO**

Reg. U. S. Pat. Off.

INDUSTRIAL OIL BURNING SYSTEMS

Heating contractors can easily match a Petro system to any size job. Every Petro system is designed to meet the specific requirements and characteristics of the particular job it is ordered for—and maintain high firing efficiency. Contractors installing a Petro system are supplied with complete engineering cooperation, including a detailed layout if desired, as part of Petro's Trade service. Even more important—the contractor can be certain that Petro is going to deliver the efficient operation desired by cost-conscious management. Combustion efficiency is held at a fixed constant in all Petro units . . . even when the fuel is pre-heated No. 6 (Bunker C) oil because the Petro Thermal Viscosity System controls the heat applied to the oil. This system, alone, permits wholly automatic operation because it eliminates all need for the frequent manual adjustments required by mechanical control of pre-heated oils.

"Blue Band" folders giving detailed information on cost reductions achieved by Petro installations are sent periodically to the trade. We will gladly add your name to the mailing list on request.

FOR AUTOMATIC—SEMI-AUTOMATIC—OR MANUAL OPERATION

Capacities—to 145 gallons per hour—454 Boiler h.p.—68,000 Sq. Ft. Steam

FOR FURTHER INFORMATION

SEE OUR CATALOG IN SWEET'S

PETRO Cuts Steam Costs

Petro's Industrial Equipment Catalog is a factual reference book, sent on request.

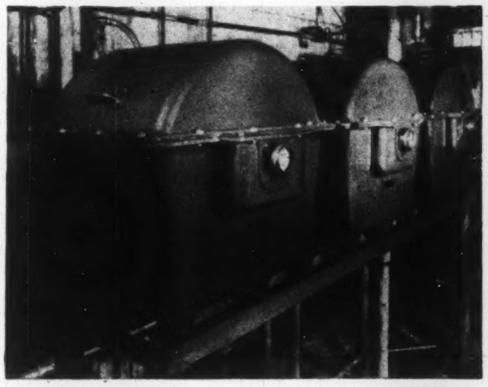
PETROLEUM HEAT & POWER COMPANY

STAMFORD —*makers of good oil burning equipment since 1903*— CONNECTICUT

GET ACCURATE STEAM COSTS FOR HEATING, PROCESSING WITH THE

ADSCO ROTARY CONDENSATION METER

An Installation in an Office Building



A view of three No. 12,000 ADSCO Rotary Meters in the Chicago Daily News Bldg., Chicago, Ill.

Available in 7 sizes
250-12,000 lbs. per hour capacity

Totalizes Steam Consumption per Building or Department—Helps You Detect Steam Losses and Improve UTILIZATION

The ADSCO Rotary Condensation Meter is the low cost answer to establishing accurate costs for steam heating per building or department. It is low in first cost, requires little maintenance beyond periodic cleaning, is easy to install, operates under vacuum or gravity conditions and is factory tested to an accuracy within 1%.

Hundreds of these meters are standard equipment on the lines of district heating companies to provide the basis for monthly billing and are used by leading industrial plants, colleges, institutions, federal, state and municipal departments.

Write for quotation giving maximum pounds of condensate per hour that the meter would be required to handle or the square feet of equivalent direct radiation in the building or department to be metered.

Write for illustrated Bulletin No. 35-80HP.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.

IN BUSINESS OVER SIXTY YEARS

IT'S SO EASY TO INSPECT
THAT GUIDED BUCKET IS GOOD ENGINEERING
THAT SIMPLIFIED PIPING SAVES MONEY
STRAIGHT THROUGH PIPING MAKES A GOOD LOOKING INSTALLATION

These Features

ARE EXTREMELY POPULAR—
THAT'S WHY *OTHERS MUST FOLLOW*

Super-Silvertop

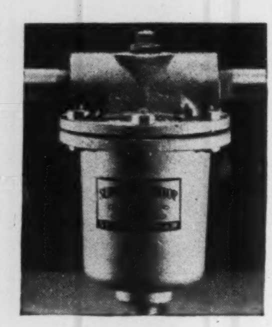
◆ Straight-line piping of inverted bucket traps is so sensible, logical, economical and popular that we predict others *must* follow the lead of Anderson Super-Silvertop.

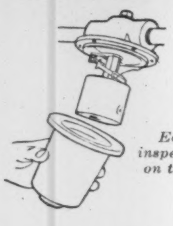
But there are other popular, important features to Super-Silvertop—the modern, engineered inverted bucket trap. There's the simplified piping of Super-Silvertop used as an elbow (no extra fittings needed). Also the ease of inspection without taking trap off the line. Then there is the extra capacity due to a larger, guided bucket (which can open a larger valve). And of course the advantage of "snap action" heat when Super-Silvertops are equipped with "snap action" Thermal Air Eliminators.

Besides *these* reasons why users specify Super-Silvertop, there are others—all described fully in the book "How To Choose A Steam Trap" which will help you on your drainage and condensation problems even if you use other makes of steam traps. Ask us for your copy—it's worth having and free, so why not write today.

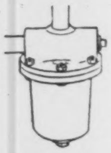
THE V. D. ANDERSON COMPANY
1949 W. 96th Street • Cleveland, Ohio

Super-Silvertop
STEAM TRAPS





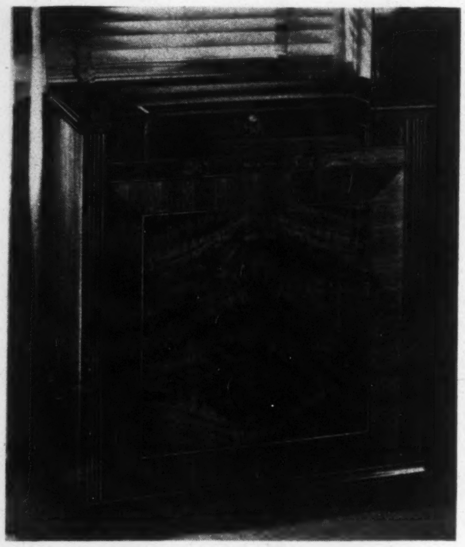
Easy to inspect right on the line.



As an elbow--no extra fittings needed.

Air Conditioning Units

No. 2111—Four new models featuring extensive mechanical improvements comprise a new line of portable air conditioning units introduced last month. Most important of the several improvements is the enlarged capacity of several models, making it possible to serve considerably larger rooms than comparable units did heretofore, says the maker. Also worthy of mention are the distinctively styled cabinets housing the various units included in the line.



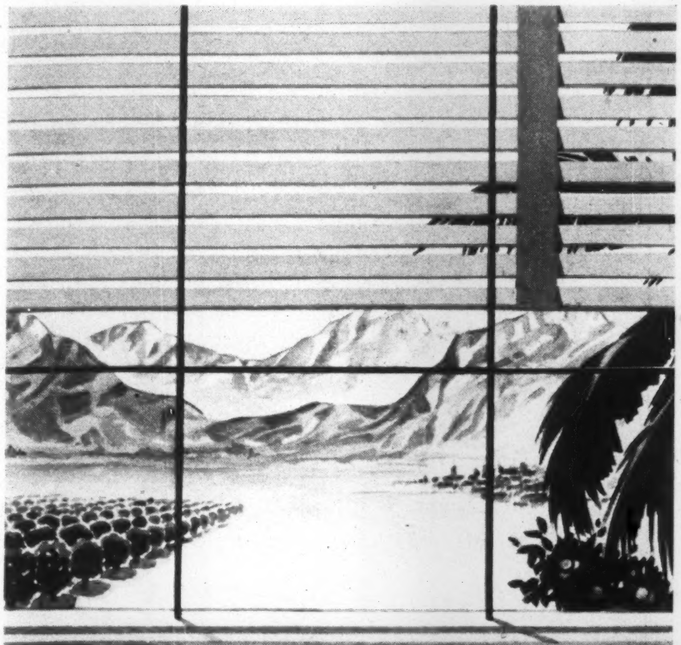
The line comprises three window units and one floor cabinet model. The window units are rated at 1/3, 1/2 and 3/4 hp.

The largest unit of the line is housed in a walnut console cabinet, has a cooling capacity up to 9100 Btu and a 3/4 hp motor, the maker states. The cabinet, itself, measures 39½ in. high, 33¼ in. wide and 16⅞ in. deep. It has an inclined grille with a control panel in the center on which is the on-off switch as well as two speed control. This design makes it possible to deflect the air stream from almost horizontal to vertical. In addition, the amount of outside air available is double that provided by the comparable unit last year. As is true of the window units, this model can be installed even on the windy side of a high building without having air leak when the unit is turned off since there is a complete seal, according to the manufacturer.—Philco Corp., Tioga and C Sts., Philadelphia, Pa.

Building Insulation

No. 2112**—A new building insulation being sold under the trade name of "Reyn-O-Cell" is made of water repellant cotton that has been treated so as to be flameproof and fire resistant. It is supplied in blankets 16 to 24 in. wide, 1 in. to 3⅝ in. thick, can be cut to the necessary lengths to meet conditions in building construction. The cotton insulation is resilient, returning to its original dimensions after any compression, the maker states.

The material is sold alone, or with asphalt impregnated paper backing, or in combination with reflective metal insulation (aluminum foil). Five of the six types are produced in mounted form, with flanges for fastening to the rafters, joists, or studs of buildings. The flanges on the insulation hold the cotton blankets in the center of the wall construction, providing space on either side for the circulation of air.—Reynolds Metals Co., Richmond, Va.



Provide California's Best Climate Indoors

Come and see the heating and air conditioning industries' newest products that improve ways to live and work with greater comfort. Come to the Pacific Coast's own Heating and Air Conditioning Exposition.

Leading manufacturers throughout the Nation will exhibit their latest and greatest contributions to indoor weather control — for health and comfort, for industrial efficiency, for commercial progress, for public welfare.

Here is an outstanding opportunity to make the most of the advantages which this exposition and the expanding building activity will stimulate. Note the place and date.

Admission is by registration.
You are cordially invited.

PACIFIC HEATING & AIR CONDITIONING EXPOSITION
Under Auspices of the American Society of Heating and Ventilating Engineers
EXPOSITION AUDITORIUM, San Francisco
JUNE 16-20, 1941
MANAGED BY INTERNATIONAL EXPOSITION COMPANY

264

FOR ECONOMICAL PERFORMANCE WITH LEAST WATER CONSUMPTION

Install

MARLO

EVAPORATIVE CONDENSERS

Available in a complete range of sizes . . . 1-100 tons. For ANY refrigerant. Indoor or outdoor models. All prime surface coils.

Efficient Marlo "Uni-Drive." Hot galvanized construction, sectional design. Lifetime-lubricated ball-bearing equipped. Silent operation.

Write for bulletin 404.

MARLO COIL COMPANY
6135 Manchester Ave. · St. Louis, Mo.
Refrigerating Equipment Manufacturers

Forged Steel Fittings

Because they give efficient, durable service, more manufacturers are turning to W-S Forged Steel Fittings to speed production and lower maintenance costs.

W-S Forged Steel Fittings are light in weight, compact, yet exceptionally strong. Regardless of what your piping requirements may be these fittings are easy to use. They can be installed in less time, with less work, yet assure tight joints.

Available in a complete range of sizes and types in forged carbon and alloy steels.

THE WATSON-STILLMAN CO.
ROSELLE • NEW JERSEY

SCREW ENDS

W-S Screw End Fittings assure a higher factor of safety because of uniform wall thickness throughout. Threads are long, accurately cut —perfectly aligned for quick easy installation. Long low bands extend beyond the last thread for better wrench grip and added strength.

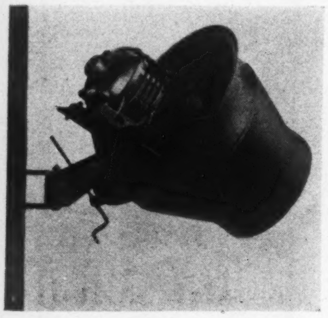
SOCKET WELDING

W-S Socket Welding Fittings greatly simplify and speed up the installation job. Deeper sockets eliminate the necessity of cutting pipe to exact lengths. No special fixtures for lining up and holding the joint are necessary. The deep socket furnishes support for the pipe and provides for self alignment.

Send for Bulletin A-3 —it gives all the facts —pressure ratings— sizes and prices—then order them from your local distributor.

WATSON-STILLMAN

Man Coolers



No. 2113—A new man cooler—known as the "Hy-V air jet"—has been especially designed for reducing fatigue of workmen in foundries, forge shops and steel mills where they are exposed to radiant heat from ovens, furnaces, forges and molten metal. It is designed to be column mounted, and is adjustable to blow in any direction. According to the manufacturer, it projects a blast of cool air in a concentrated stream to remote spaces without the aid of ducts.—De-Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.

Steel Air Diffusers

No. 2114—It has been found that in some cases steel is suitable for the manufacture of "Anemostat" air diffusers, particularly where the units are not subject to the corrosive action of gases encountered in certain chemical plants used for defense production, according to a recent announcement. The manufacturer has, therefore, gone to the expense of tooling up to spin the largest and second largest cones of the type "B" and "C" diffusers out of a special ductile spinning steel. The company's types "CCB," "CCM" and "HU" dif-

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You take no chances with Patterson Hot Water Storage Heaters, for they are in successful operation in thousands of buildings and we have specialized in their manufacture for 61 years.

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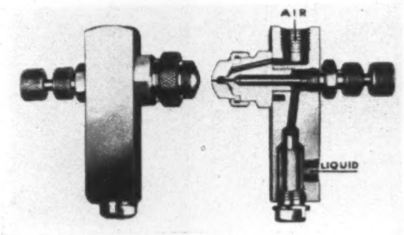
fusers are already manufactured entirely of steel, in line with the aluminum conservation program.

It has been found, says the manufacturer, that steel has a certain advantage for ceiling and wall type air diffusers; it has greater strength, and the units with the steel outer cone are therefore less apt to be damaged in transportation and during installation. It is stated that the labor cost of spinning steel has been found to be higher than the cost of spinning aluminum and this increase is greater than the lesser cost of the raw material. However, prices have not been advanced because of this. —Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.

Pneumatic Atomizing Nozzle



No. 2115—The pneumatic atomizing nozzle illustrated is available with an integrally mixed round or flat spray, with a fluid shut-off needle optional. The air connection is ¼ in. and the fluid connection is ⅛ in. pipe thread. The strainer is removable.

Offered for chemical and industrial process use and humidifying, standard stock construction is brass with "Monel" metal strainer, but other metals can be specified.—Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.

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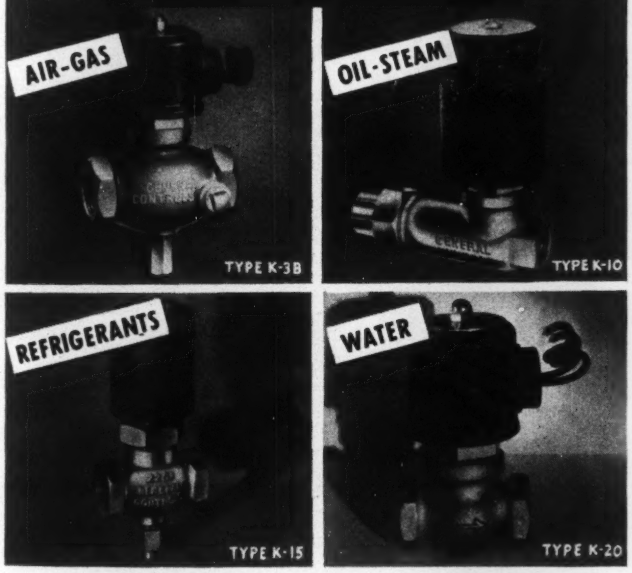

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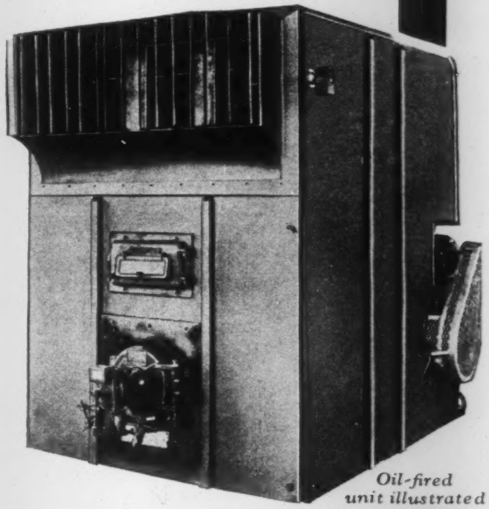

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That is the *certain* way to supply warmth and a pleasurable feeling of well-being, no matter how widely or wildly the weather changes; the certain way to relieve the discomfort of too much heat in mild weather; the certain way to match heat so closely to human requirement that—like the clothes on a well dressed man—it is unobtrusive.

Consulting Engineers in all sections of the country are specifying Dunham Sub-atmospheric Steam Heating because it holds fuel costs to the minimum; provides control in an accurate automatic manner; and minimizes replacement costs to a negligible matter even after years of service.

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Book Reviews

Psychrometric Tables

[Psychrometric Notes and Tables, by Elmer Torok, superintendent of power, North American Rayon Corp. 2nd ed. 1941. 125 + viii pp., 4½ x 6¾ in., flexible binding. Published by North American Rayon Corp., 261 Fifth Ave., New York, N. Y. Available upon request.]

The purpose of this handbook of psychrometric principles, tables and calculations for textile manufacturers, engineers and students, is to place all necessary information in one volume at the disposal of those interested in air conditioning work.

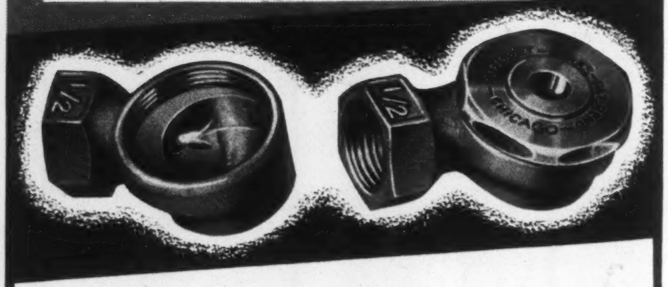
There is a chapter on the principles of air conditioning, seven extensive psychrometric tables of use in calculations, examples illustrating the use of the tables, a compilation of heat transmission coefficients for building materials, a section on heating and cooling calculations, and a 5 p. alphabetical table of conversion factors.

ASTM Proceedings

[Proceedings of the Forty-Third Annual Meeting. 1941. Volume 40. 1396 + viii pp., 6 x 9 in. Published by the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa. Prices: heavy paper binding, $8.50; cloth binding, $9.00; half-leather, $10.00.]

A summary of the proceedings is first given, followed by the presidential address on standard specifications for materials and their commercial importance. Following

THE PERFECT NOZZLE
FOR AIR CONDITIONING
...ROTOJET by BINKS



Rotojet breaks up the fluid into an ultra fine uniform spray. Specially designed for air conditioning, refrigeration and similar uses. Comes in a wide variety of sizes and capacities. Precision made of tough marine bronze. Also available in special alloys and stainless steel. **WRITE FOR BULLETIN 250,** which describes this and other BINKS spray nozzles.

BINKS MANUFACTURING COMPANY
3114 CARROLL AVENUE Dept. H440 CHICAGO, ILLINOIS

this are the committee reports on ferrous and non-ferrous metals, and on masonry and miscellaneous materials.

Numerous technical papers conclude the book, being grouped according to the following subjects: significance of the tension test of metals in relation to design; metals; cement, concrete, lime, refractories, and masonry materials; miscellaneous; problems in the classification of natural water intended for industrial use; spectrographic analysis; tools of analytical chemistry; and radiographic testing of airplane components.

Coming Events

Producers' Council: Annual meeting, May 7-9, Stevens Hotel, Chicago, Ill. J. W. Follin, managing director, 122 E. 42nd St., New York, N. Y. Papers to be given on the subject of the prospect for construction and demand for building products, including possible demand of defense work for building products and possible effect of priorities on private construction, the supply and demand of building labor, public works policies during and after the emergency, and the necessity for maintaining private residential construction to supply defense housing community needs.

Anthracite Conference: Fourth annual anthracite conference, May 8-9, Packard Laboratory, Lehigh University, Bethlehem, Pa. Sponsored by Anthracite Industries, Inc., Chrysler Bldg., New York, N. Y. Program includes papers on practical pointers in the installation of domestic stokers, by Joseph K. Goundie; trends in

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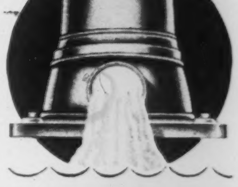
IF YOU ARE "ON THE SPOT" FOR MORE WATER



In these days of high speed production, you cannot afford water shortage. For men, machines, materials—and fire protection, you must have an abundance of water at all times. In the scene above, some 25,000,000 gallons of water daily are being produced from Layne Wells and Pumps for an important industry. Your needs may not be so great—or they may far exceed that amount. In any event Layne—the world's largest water producers—can, with speed and efficiency fulfill your needs. Layne has both the man power and equipment to speedily complete well water systems of any size.

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An authoritative up-to-date listing of all the products that go into "big building and industrial" heating, piping and air conditioning systems . . . names of all manufacturers who make them, trade names and addresses . . . part of regular January issue . . . bound in special, heavy, varnished cover to stand up against wear and tear of constant use . . . out early in January for service throughout the year. Write for details.

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boiler and furnace design to give greater efficiency with anthracite, by M. A. Young; future research for the anthracite industry, by Frank C. Wright, Jr.; anthracite research at Mellon Institute, by Harold J. Rose; advanced developments on the control of the combustion of anthracite, by Allen J. Johnson; factors affecting human comfort in addition to temperature, by C. P. Yaglou; activated carbon from anthracite, by Eric Sinkinson; performance of anthracite-fired water heaters, by R. C. Johnson; and a general summary of conference papers, by A. C. Callen.

New York State Society of Professional Engineers: Annual convention, May 8-10, Hotel Commodore, New York, N. Y., in combination with exhibit of equipment, supplies and methods. Headquarters office, 1941 Grand Central Terminal Bldg., New York, N. Y.

Underwriters Anniversary: 75th anniversary celebration of the founding of the National Board of Fire Underwriters, May 27-28, Waldorf-Astoria Hotel, New York, N. Y. W. E. Mallalieu is director of the 75th anniversary activities for the board.

American Society of Refrigerating Engineers: Spring meeting, May 27-29, Gibson Hotel, Cincinnati, Ohio. Headquarters office, 37 W. 39th St., New York, N. Y.

Association of Gas Appliance and Equipment Manufacturers: Annual convention, June 3-5, Ambassador Hotel, Los Angeles, Calif. Headquarters office, 60 E. 42nd St., New York, N. Y.

Smoke Prevention Association: Annual convention, June 3-6, Hotel Ansley, Atlanta, Ga. Secretary-treasurer, Frank A. Chambers, department of smoke inspection and abatement, City Hall, Chicago, Ill.

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"Astonishing Economy"
. . . in the installation of 54,000 feet of pipe . . . over 10½ miles . . . in this outdoor skating rink . . . 4,448 connections *without a leak*. Here's vivid proof of Key-Tite's greater coverage which makes it the most economical sealing compound to use on all thread and gasket connections.

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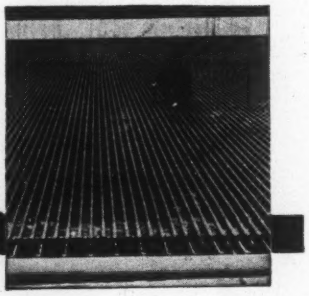

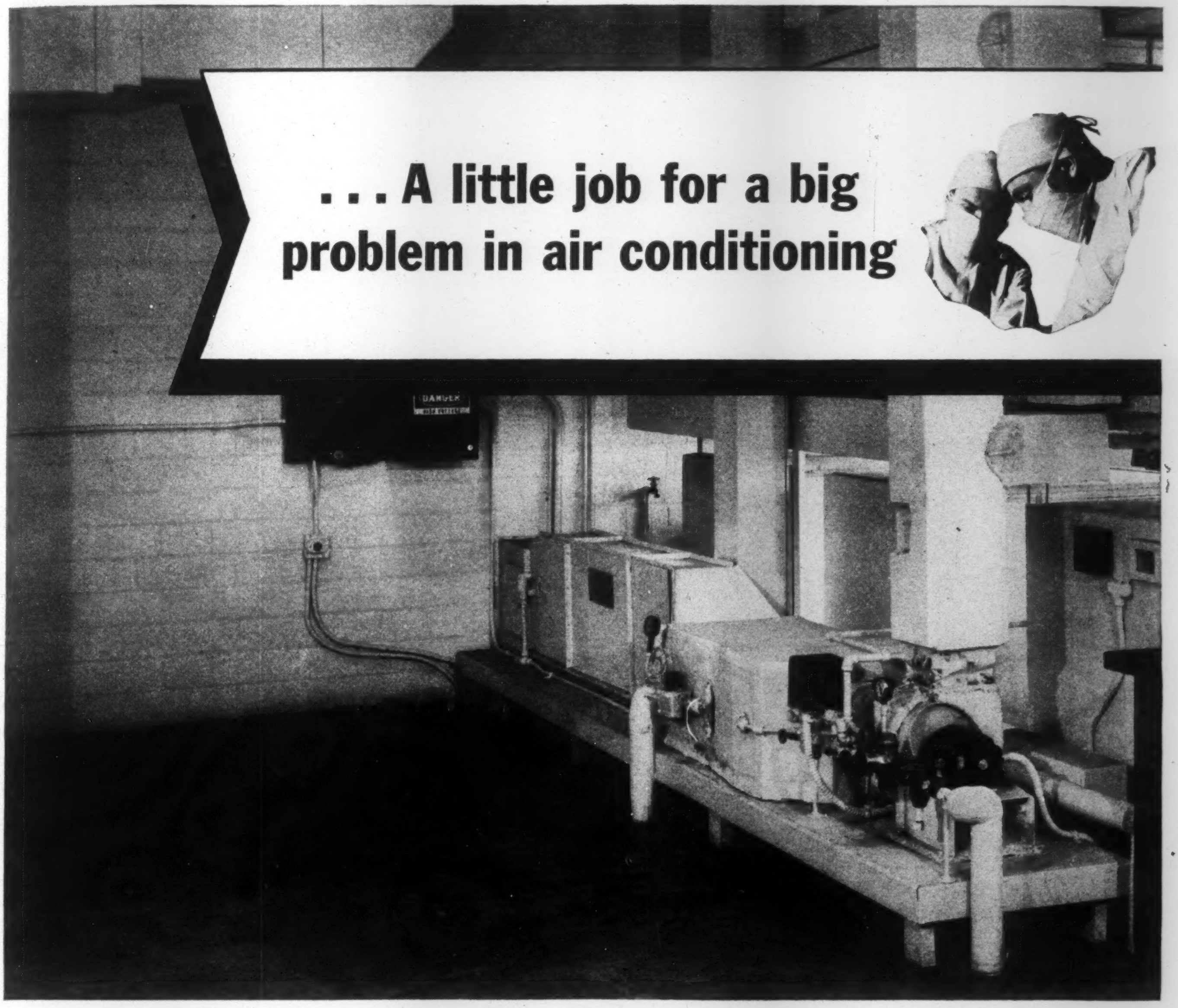

. . . A little job for a big problem in air conditioning

THE Kettering Biological Laboratory of the University of Cincinnati is studying the effects of dusts and gases on the health of workers in industry. They are experimenting now on monkeys and guinea pigs.

To help maintain rigidly controlled conditions, a miniature air conditioning unit was especially designed and built. Small though it is, it has most of the advanced features of the newest, big public building units.

A notable feature is the 2″ duct—made of 16 oz. Revere copper. Copper was chosen for the protection it gives from the gases—many of them corrosive to other metals—used to simulate industrial conditions.

Here is another instance where Revere is helping researchers and manufacturers solve big problems by helping solve little problems for them. The Revere Technical Advisory Staff—armed with much research data, as well as practical experience in the application of copper, brass, bronze and other copper base alloys—are at your command. It may be this Revere service can help you settle some little problem that's holding up a big job.

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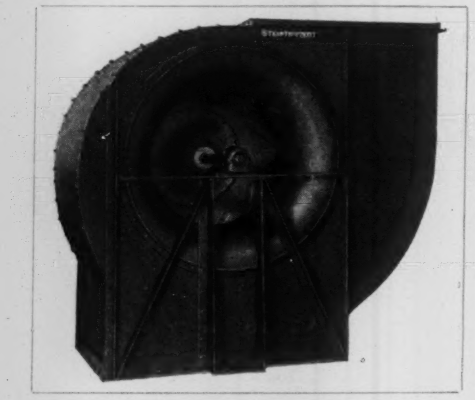
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Low Outlet Velocity Fan

No. 2116—A new fan designed primarily for heating, ventilating and air conditioning is known as the "Silentvane Design 8." It possesses two characteristics which particularly suit it to such duty, quietness of operation and low outlet velocity, according to the manufacturer. Though made in class I only, the fan is built to stand up under the most exacting heating, ventilating and air conditioning duties. Housings are of steel plate with rolled bead joints reinforced with bracing angles. Side and back plates of the rotor are cut from heavy stock and the back plate is securely riveted to cast iron hub. Blades are die formed, riveted to the back plate, and welded to the shrouds. In accordance with NAFM standards for class I fans, it is designed for a maximum tip speed of 9000 fpm.

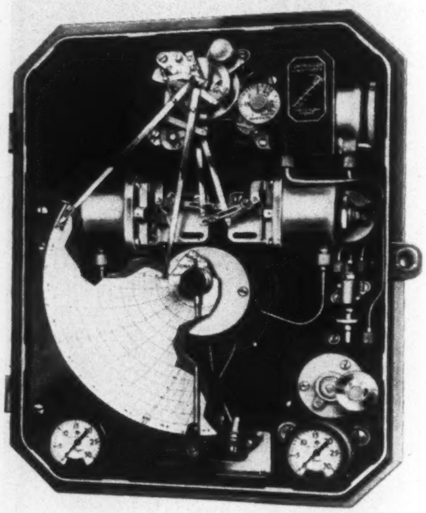


This fan is available in all standard discharges, single and double width, single and double inlet, with wheel diameters ranging from 12¼ to 87¾ in.—B. F. Sturtevant Co., Damon St., Hyde Park, Boston, Mass.

Direct Set Ratio Controller

No. 2117—A highly adaptable, easily convertible instrument for applications where a temperature, pressure, rate of flow or liquid level must be controlled in a desired ratio or differential to another related variable was recently announced.

With the new direct setting ratio controller, the ratio is changed by a screw driver adjustment directly on a calibrated dial throughout the range of 0:1 to 3:1, direct or inverse. With this new instrument it is unnecessary to disturb the processing or remove the chart plate while making ratio adjustments, it is stated.

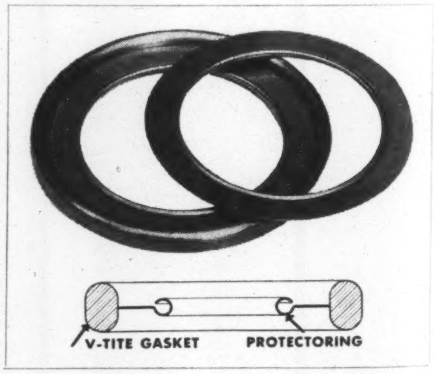


The ratio controller has two measuring systems, one the adjusting system which indicates or records only, and the other (the controlling system) which may either indicate or record. The adjusting system resets the control point of the controlling system through a linkage arrangement according to a predetermined ratio.

Both indicating and recording models of the ratio controller are available with all the features of the "120R Series Fulscope."—Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.

Seal for Ring Joints

No. 2118—An improved auxiliary seal or "Protectoring" for use with "V-Tite" gaskets as used in ring type joint flanges was announced recently. It is a formed ring, which is placed between the flange faces inside the primary ring gasket.



It is designed to perform three distinct functions, says the maker: First, to protect the inner surfaces of the primary gasket and the otherwise exposed flange faces from chemical attack by the confined

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [6-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2116	2117	2118	2119	2120	2121	2122	2123	2124	2125
2126	2127	2128							
3886	3887	3888	3889	3890	3891	3892	3893	3894	3895
3896	3897	3898	3899	3900	3901	3902	3903	3904	3905
3906	3907	3908	3909						

Name ....Title..........

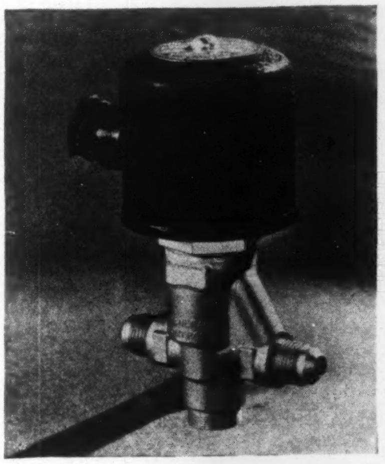
Company ....

Address ....

City ....State..........

medium; second, to eliminate turbulence in pipe lines caused by eddying of the flowing liquid in the space between the mating flanges; and third, to prevent erosion in flange faces and the primary gasket which results from the scouring action of liquids in motion, especially high velocity streams.—Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.

Refrigerant Valve



No. 2119—A new valve designed for the control of refrigerants—such as sulphur dioxide, "Freon" and methyl chloride—has the following features, according to the manufacturer: Low power consumption, quiet two wire solenoid, freedom from a-c hum, simplicity of design and packless construction. The bodies are forged and coils are moisture resistant. A non-corrosive, hardened, wear resistant needle insures positive control. Maximum operative fluid temperature is 240 F.

These valves are particularly recommended by the maker for small applications, and are efficient for fractional tonnage installations where continued tight shut-off is necessary. They are also capable of handling larger capacities up to 2.5 tons "Freon." They also operate on air, water, gas and light oil, and are available with sweat or flare soldered connections.—General Controls Co., 801 Allen Ave., Glendale, Calif.

Magnetic Starter

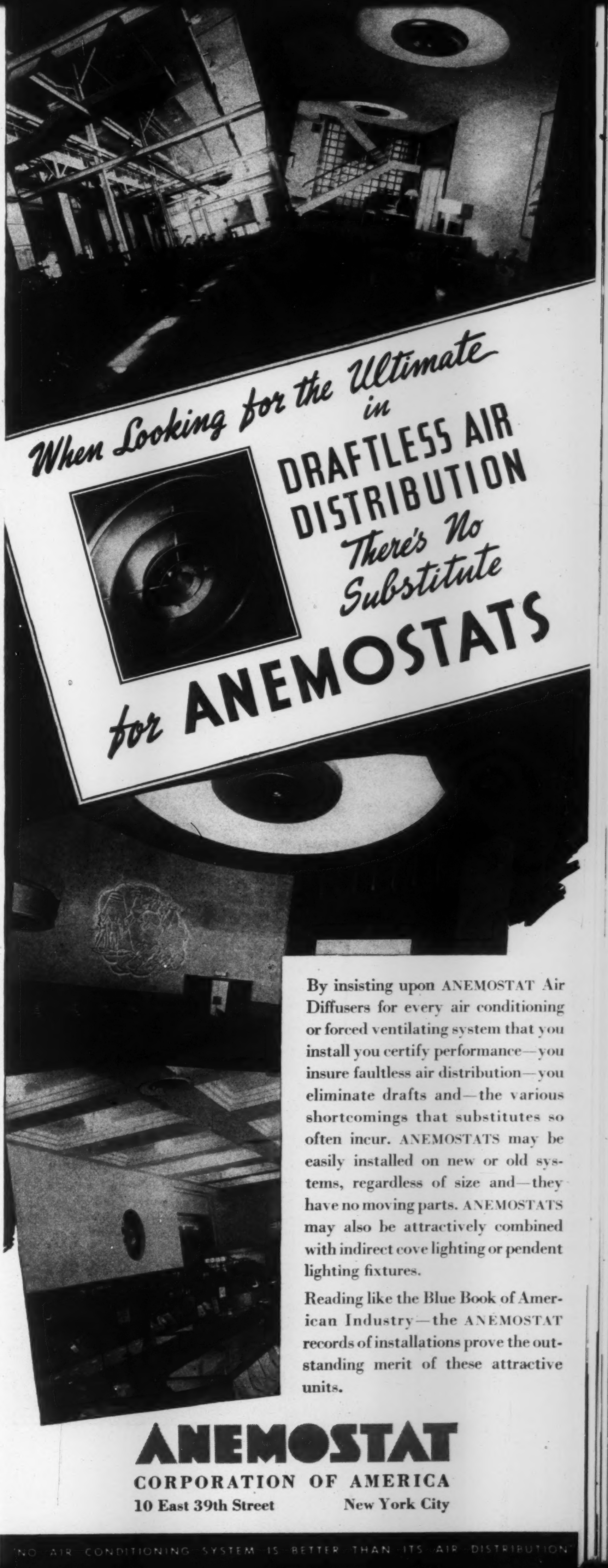
No. 2120—A new lift type, full voltage magnetic starter which operates quietly is especially suited to the control of small condensing units, small air conditioning fan motors, or any a-c motor where quiet operation is important, the maker states.

It handles motors up to 5 hp and 220 volts, starting, stopping and protecting them from overloads and overheating by means of manual or automatic reset isothermic overload relays. It is mounted in a heavy, gasketed, cast iron, watertight housing, which muffles the sound of the contactor operation. To further isolate the sound, heavy rubber bushings separate the three pole contactor from its enclosure.—General Electric Co., 1 River Rd., Schenectady, N. Y.

Pneumatic Insertion Thermostats

No. 2121—Two additions to a line of pneumatic controls have been announced—new master and submaster insertion thermostats.

The submaster thermostat may be used to operate valves or dampers to control the temperature of air or liquids while the master thermostat, measuring the temperature of some other medium, such as outdoor air, automatically resets the control point of the submaster



By insisting upon ANEMOSTAT Air Diffusers for every air conditioning or forced ventilating system that you install you certify performance—you insure faultless air distribution—you eliminate drafts and—the various shortcomings that substitutes so often incur. ANEMOSTATS may be easily installed on new or old systems, regardless of size and—they have no moving parts. ANEMOSTATS may also be attractively combined with indirect cove lighting or pendent lighting fixtures.

Reading like the Blue Book of American Industry—the ANEMOSTAT records of installations prove the outstanding merit of these attractive units.

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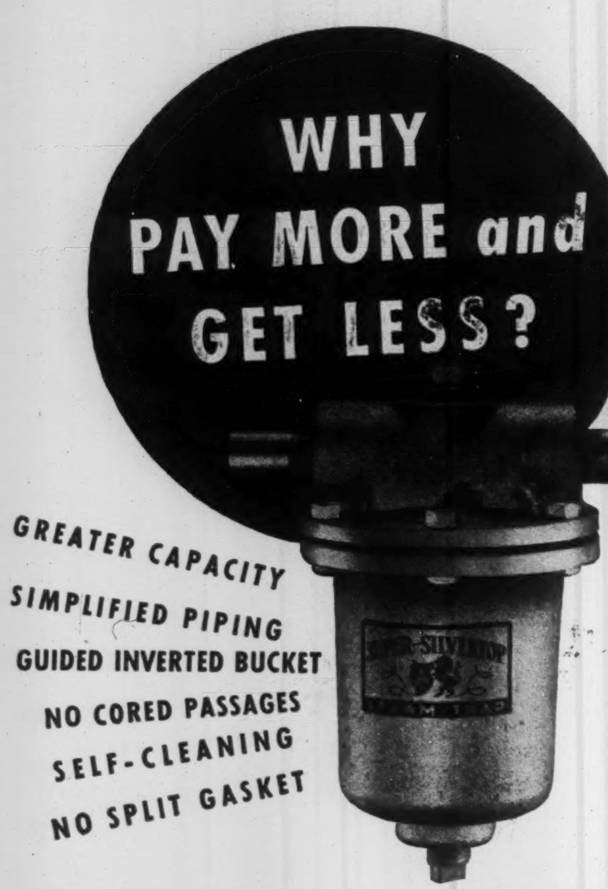
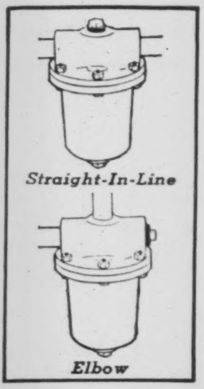
"NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTION"



THESE ARE THE FEATURES OF SUPER-SILVERTOP STEAM TRAPS

Anderson Super-Silvertop inverted bucket Steam Traps are easier to install, either elbow or straight-in-line (see drawings below). Because bucket is guided, a larger bucket can be put in the same size body, this, combined with a longer lever arm, opens a larger valve (and opens it wider) to give increased trap capacity. Also, Anderson Super-Silvertops have no cored passages which might restrict the flow or become clogged with scale—all passages are drilled or bored smooth. Finally, gasket in Super-Silvertop is not pierced for steam passage—there is no split gasket that can be a possible source of steam leaks.



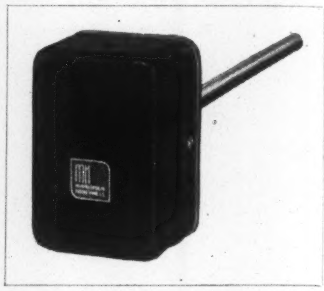
All these features are yours in Super-Silvertop—eventually others *must* follow the lead of Super-Silvertop because the advantages of this design are so popular among steam trap users. But why wait for that time to come?—you can get Super-Silvertop now! The book "How To Choose a Steam Trap" gives complete details—write today for your free copy.

THE V. D. ANDERSON CO.
1949 W. 96th St. • Cleveland, Ohio

Super-Silvertop
STEAM TRAPS

thermostat as the outdoor temperature changes. In a hot water heating system, for example, the submaster control in the hot water supply may be set to raise the water temperature from 100 F to 180 as the outdoor temperature, measured by the master controller, drops from 60 to 0 F.

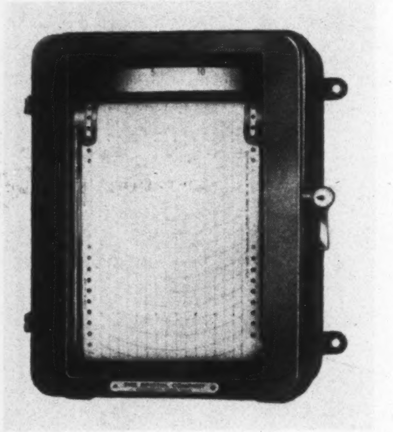
The sensitive rod and tube type of element permits accurate control over a wide range of temperatures, the maker states. Both controllers have a scale range of —20 to 120 F. The submaster controller may be adjusted to increase the control point 25 to 150 F. The master controller may be adjusted to produce the desired change in control point as the temperature of the outdoor air (or other medium) changes over a span of 15 to 75 F.



Economical use of compressed air is assured because of the "non-bleed" type of construction. No air is allowed to bleed from the system except while the damper or valve is changing position. All adjustments are inside the case to discourage unauthorized tampering, but are readily accessible when the cover is removed.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

Strip Chart Recorder

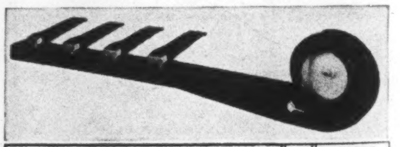
No. 2122—A newly designed strip chart recorder includes a new case design, chart drive, measuring elements and writing mechanism.

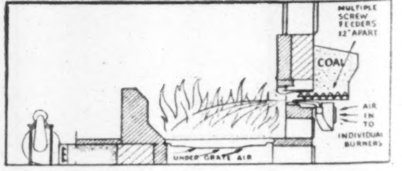


These instruments are available for recording, on a 6 in. strip chart, d-c volts and millivolts, d-c amperes and milliamperes, pressure, liquid level, flow, temperature, motion, and for remote recording, using the "Metameter" system of telemetering.—The Bristol Co., Waterbury, Conn.

Manifold for Spreader Stokers

No. 2123—Ability to spread small sizes of coal in a predetermined pattern conforming to furnace grate area with less than 25 per cent plus or minus cumulative variation is the performance claimed by the manufacturer for a new noiseless type of low pressure air injection manifold developed for use on a line of spreader type stokers.




MULTIPLE SCREW FEEDERS 12" APART
COAL
AIR IN TO INDIVIDUAL BURNERS
UNDER GRATE AIR

The manifold is designed to connect directly to a standard 1750 rpm low

WHY PAY 800% MORE?

Every time you replace a worn Bronze Gate valve with a new one, you are paying about 800% *more* for that new valve than it would cost to repair a Fairbanks Renewable Bronze Gate Valve. For when the Fairbanks seat rings wear, they can be replaced for about 10% of the original cost of the valve . . . then the valve is as good as new.

Fairbanks Renewable Valves

also save time, labor and expense by enabling you to make renewals in a few minutes without removing valves from the line or disturbing pipe coverings.

Why not stop this deplorable waste now by replacing worn valves with Fairbanks "Renewables"? They're made in bronze and iron, in types and sizes to meet practically every requirement.

Write today for Catalog No. 21 and name of our nearest distributor.

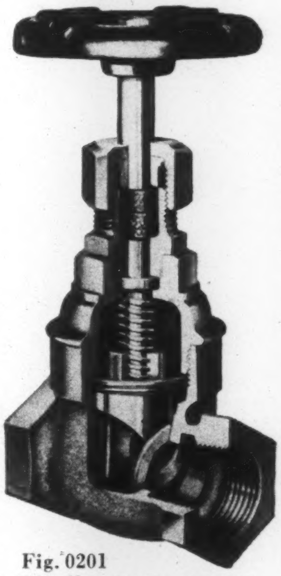
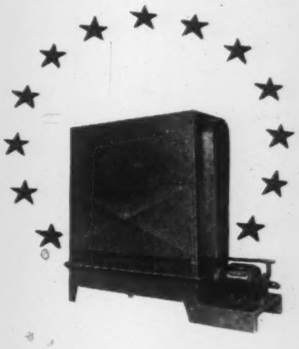


Fig. 0201
150 *lbs. steam pressure*

THE FAIRBANKS COMPANY
Valves, Dart Unions, Hand Trucks and Wheelbarrows
396 Lafayette St., New York, N. Y.
Boston, Mass., Pittsburgh, Pa.—
Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

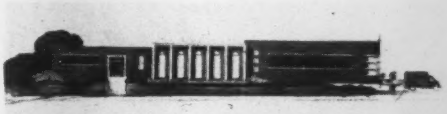


An Explanation and Apology

The demands made upon us for the current National Defense Program for much of our type of equipment, plus the difficulties in obtaining raw materials from outside sources of supply, have made our deliveries and service much below our customary standards.

Government priorities must be and have been respected. Civilian and non-defense orders have of necessity suffered. With this explanation as to cause, we offer our apologies for whatever inconveniences and disappointments that have resulted or which may result in the future.

Our new plant facilities, (illustrated below) now being built and within sight of completion, will do much to relieve the present circumstances. We are glad that we shall shortly again be able to render the kind of service that has made these increased facilities necessary. Meanwhile, we respectfully ask your indulgence and forbearance.



MARLO
COIL COMPANY
6135 Manchester Ave., St. Louis, Mo.
Refrigerating Equipment Manufacturers

Humidity Control & Air Conditioner
USING PATENTED CHEMICAL

■ LOW FIRST COST
■ LOW OPERATING COST

Calorider
TRADE MARK REG. U. S. PAT. OFF.

At last, Humidity Control and Air Conditioning at a very low first cost and an exceptionally low operating expense.

The CALORIDER is a scientifically designed Unit to DEHUMIDIFY AIR—to FILTER and COOL AIR—and to HUMIDIFY AIR in Winter. Encased in an all metal cabinet, the CALORIDER delivers up to 1500 cu. ft. of air per minute; also small portable Units—100 to 250 cu. ft. of air per minute.

The CALORIDER is charged with a patented, moisture absorbing chemical, "Caloride." Air drawn through the Unit comes into contact with this chemical which removes MOISTURE, DUST, ODORS and POLLEN.

The CALORIDER will solve, at a reasonable cost, many commercial problems where humidity control is essential, either in manufacturing or storage.

Write Dept. HP Today, for information and engineering data on CALORIDERS.

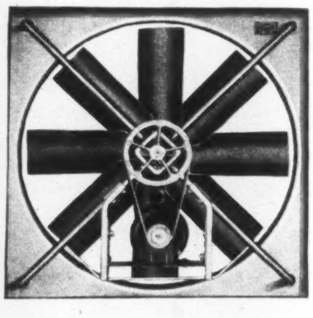
The General Air Conditioning Corporation
Appleton Street—Cincinnati, Ohio

pressure air blower. One air outlet nozzle is provided to protrude directly below each of the mechanically driven coal delivery screws of the stoker. The shape of each nozzle is worked out to give flat, fanshaped spreading of coal. Adjustment for various sizes of coal, wet or dry, is secured with a main manifold damper and small individual dampers on each spreader nozzle.

Additional advantages claimed for this method of coal feeding are that it eliminates need for high speed moving mechanical parts within the high temperature part of the furnace, automatically supplies the overfire air needed for burning coal fines in suspension, and simultaneously creates turbulence in the furnace chamber favorable to higher combustion efficiency.

The field for application is expected to be in small and medium size steam plants where modernization of existing furnaces is desired.—American Coal Burner Co., 155 E. Superior St., Chicago, Ill.

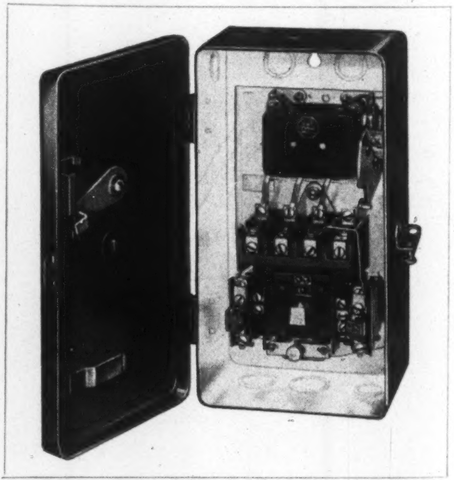
Fan Redesigned



No. 2124—An all purpose quiet operating ventilating fan with numerous industrial and commercial applications introduced to the market about a year ago has been improved through redesign by changing it to a multiple bladed unit in place of the three bladed construction. The new blade assembly is designed to overcome normal restrictions in the air flow, to prevent churning the air and, at the same time, to absorb shocks and sudden changes in air loads that ordinarily overtax motor capacities, says the maker. The fan operates with v belt drive from a standard speed (1725 rpm) motor.

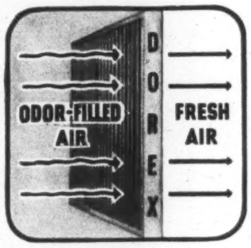
The fan bears the trade name "Allvent" and is furnished in capacities of 5000 to 23,000 cfm. Units up to 36 in. diameters have six blades, and sizes up to 54 in. have eight blades.—Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill.

Combination Starters



No. 2125—A unique handle locking arrangement and a compact high capacity disconnect switch are among the several features of the new "Bulletin 712" line of combination starters recently developed. A magnetic switch is combined with a hand disconnect switch in the same enclosure to save wiring, improve safety, and to result in a compact installation of good appearance.

SWAP SMELLS FOR PROFITS



. . . and the worse the smells, the greater the loss in profits. Regardless of the effectiveness of air conditioning equipment you install, if you fail to provide for the control of accumulating odors they will reduce employee morale and efficiency, annoy customers, contaminate products—steal profits.

Dorex Odor Adsorbers furnish the one positive method of extracting gaseous impurities from the air. Highly activated coconut shell carbon does the job by the principle of adsorption—the same as that employed in the gas mask.

Type H is but one of the Dorex units available for practically every type of commercial or industrial odor problem. This type is recommended for contaminated fresh air intakes, odorous exhausts, and odor accumulation in recirculation systems. It consists of multiple, removable, carbon-filled, perforated metal canisters which can be easily installed in the air duct or conditioner casing, so that the air must pass uniformly through their purifying media. The enormous gas adsorption and retention capacity of Dorex carbon insures long service life—frequently as long as two years, or more. Upon exhaustion, it can be reactivated and re-used.

Many Dorex Odor Adsorbers are now in operation in hospitals, offices, factories, restaurants, theatres, homes, stores, cold storage companies, laboratories, locker plants and railroads.

Dorex Adsorbers pay for themselves out of savings. *Bulletin H-6, What Dorex Odor Adsorbers Mean to Air Conditioning*, brief and concise, contains facts and figures. From it you can determine almost at a glance just how much Dorex will save on any given job, regardless of size. Write for your copy today.

DOREX
DOREX

"WORKS LIKE A GAS MASK"

DOREX

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ODOR ADSORBERS

DOREX DIVISION
W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street, New York, N. Y.

FOR ODOR-CONTROL IN AIR CONDITIONING, COMMERCIAL VENTILATION AND INDUSTRIAL PROCESSING

WITH BARBER B-C COLMAN *ELECTRIC* CONTROLS

P·R·O·P·E·R E·N·G·I·N·E·E·R·I·N·G

SPELLS ▶ *DEPENDABLE PERFORMANCE*

▶ *LONG LIFE*

▶ *MINIMUM MAINTENANCE*

BARBER-COLMAN COMPANY PLANT AT ROCKFORD, ILLINOIS

VEE-PORT VALVE with Type CYBG Operator

● An outstanding feature of Barber-Colman ELECTRIC Temperature and Humidity Control Systems is ENGINEERING SERVICE. The installation is carefully planned in every detail and is then backed with a positive *guarantee of satisfactory operation*. Quality materials, high manufacturing standards, and attention to accuracy both in construction and performance, assure that Barber-Colman ELECTRIC Controls will provide long and dependable service, with maintenance costs held to a minimum.

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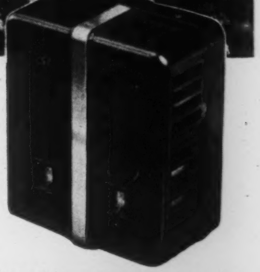
Established 1902

The basic aim of Barber-Colman Company for over 38 years has been sound engineering, and the manufacture of dependable products, designed primarily for accurate performance and long life.



MICROTHERM

An outstandingly sensitive and responsive control instrument, originated and developed by Barber-Colman Company.

1228 ROCK ST. **BARBER-COLMAN COMPANY** ROCKFORD, ILL.

In every low-temperature insulation service

J-M ROCK CORK DOES THIS THREE-WAY JOB

ROCK CORK INSULATION on air-conditioning duct before application of cement finish.

Rock Cork provides permanent efficiency! Unusually moisture resistant, minimizes moisture infiltration . . . the cause of most low-temperature insulation failures. Installations made many years ago still retain their high insulating effectiveness . . . show no signs of deteriorating.

Rock Cork provides installation savings! Light in weight and easy to handle, Rock Cork can be quickly applied. On the job, costs stay low. For Rock Cork is basically mineral . . . rotproof, unusually durable. Little maintenance is required.

Rock Cork provides low initial costs! You pay no more for Rock Cork than for other low-temperature insulations. And you're sure of complete uniformity, for Rock Cork is made to an exact formula under rigid laboratory control.

You should have all the facts on the advantages J-M Rock Cork offers for use on refrigerating equipment, cold lines and air-conditioning ducts. Write for brochure DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE
JM ROCK CORK
LOW-TEMPERATURE INSULATION. IN SHEET FORM AND FOR PIPE COVERING

These combination starters are available in four sizes in a variety of enclosures, with or without fuse clips. Ratings range from 2 hp, 220-440-550 volts, to 30 hp, 220 volts, and 50 hp, 440-550 volts. All sizes have an interrupting capacity of at least 10 times the maximum horsepower rating, the maker states. Locked rotor currents are disrupted by either the solenoid switch or the disconnect switch.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

Ceiling Diffusers

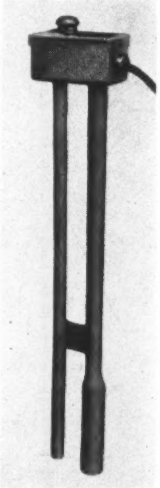
No. 2126*—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y., announced last month the purchase of the assets of Plandaire, Inc., Pittsburgh, Pa., manufacturers of ceiling diffusers widely used by industrial and commercial concerns, the navy, and other governmental agencies.

"Plandaire" ceiling diffusers, which regulate the inflow and velocity of air from supply ducts, are a natural complement to the "Dorex" line of adsorbing equipment, which is used in factories, offices, homes, hospitals, stores and other establishments for the elimination of odors and gases of all kinds, according to the announcement.

Immersion Heaters

No. 2127—The new "BLC Chromalox" immersion heater with thermostat control is used and recommended for sulphuric, hydrofluoric and fluoride solutions; sulphurous compounds; acid copper electroplating solutions; chromium electroplating solutions; and ordinary warm nickel electroplating solutions only. It is especially recommended by the maker for corrosive conditions where lead only is suitable. All immersed parts are lead coated.

A standard immersion heater is enclosed in one leg with a heated section 5½ in. long by 1¼ in. diameter, rated at 500 watts. The second leg consists of a parallel tube 21 in. long by 9/16 in. diameter, enclosing the sensitive bulb of a thermostat providing flexible temperature control by means of an adjusting knob. Electrical connections are made within a brass box on the top of the heater. Overall dimension of the 500-watt heater is 25 in.—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh, Pa.



Room Coolers

No. 2128—Two new room coolers announced for the 1941 summer season are the ½ hp "Lake Louise," a window sill model 23 in. long developing up to 6100 Btu cooling capacity, and the 1/3 hp "Lake Placid," designed primarily for comfort cooling bedrooms and small private offices, and with capacity up to 4700 Btu.

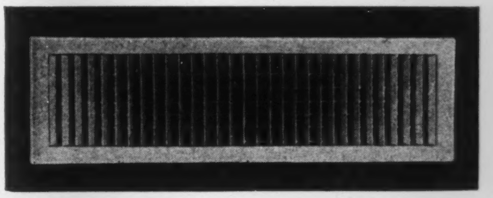
Both models are easily installed without ducts or pipes or window alterations, the maker states. The unit rests on the window sill, and space on either side is filled in with baffles. The window closes on a layer of sound deadening felt, keeping heat and noise out and conditioned air inside.—Gale Products, Galesburg, Ill.

Waterloo
AIR DIFFUSION EQUIPMENT

This Super-Flexible Grille

makes air go *where you want it!*

• For real flexible air control, the Waterloo FG-V-75 has no equal. Both front and rear blades are individually adjustable to control direction, throw, and volume, and may be completely closed if desired. Streamlining of louvres permits higher velocities with less noise. Easily adjusted after installation to correct any unforeseen conditions of air distribution. Also available with front blades in horizontal position.—Write for Free catalog showing the FG-V-75 and other Waterloo Units which will help you improve the performance of your air conditioning installations.



Waterloo FG-V-75
Adjustable Double Directional
Supply Grille

WATERLOO REGISTER CO., Waterloo, Iowa, and Seattle, Wash.
Representatives in principal cities

Now Only $2.00 for This Outstanding Book on Air Conditioning!

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The Third Edition of
AIR CONDITIONING FOR COMFORT
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Easy to understand . . . accurate . . . comprehensive . . . up-to-date—these are the features of this third edition of Samuel R. Lewis' well-known AIR CONDITIONING FOR COMFORT. More than 70% of the text in this third edition is entirely new, as are dozens of the illustrations, charts, tables, and designing examples.

Fundamentals are fully and clearly covered in this volume, as are the newest air conditioning methods and equipment. Correct procedure in designing complete systems for both residences and large buildings is explained step by step from the standpoint of newest practice. In addition, considerable original data on such comparatively new subjects as standards, noise control, measurements, and fire protection codes has been included.

Send $2.00 for a copy today to the address below. We know you will consider this one of the finest air conditioning books you have yet seen, but if you should be dissatisfied with it for any reason whatever, your money will be promptly returned to you.

KEENEY PUBLISHING COMPANY
6 No. Michigan Avenue Chicago, Illinois

Coming Events

National District Heating Association: Annual meeting, June 10-13, William Penn Hotel, Pittsburgh, Pa. Secretary-treasurer, John F. Collins, Jr., 825 N. Euclid Ave., Pittsburgh, Pa. In addition to numerous committee reports, program includes papers on problems of steam generation and use in institutional building groups and industrial concerns, by A. A. Cummins and H. N. Barnard; the new Ottawa St. steam heating station in Lansing, Mich.; operating experience on a 900 psi steam line; heat loss with 2 in. steam line at low velocities, by Thomas Ravese; results of zoning, by V. B. Ingram; research trends in heating, by F. C. Houghten; absorption refrigeration, by W. F. Friend; panel heating, by T. Napier Adlam; steam jet operation, by Richard E. Hull; suitability of the 65 F degree day base for heating calculations, by S. S. Sanford; thermostatic trap maintenance, by R. Y. Sigworth; and standard for building volume measurement, by W. F. Friend.

American Society of Heating and Ventilating Engineers: Semi-annual meeting, week of June 16, Palace Hotel, San Francisco, Calif. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: Annual convention, week of June 16, Hotel St. Francis, San Francisco, Calif. Headquarters office, 1250 Sixth Ave., New York, N. Y.

Pacific Heating and Air Conditioning Exposition: June 16-20, Civic Auditorium, San Francisco, Calif. Under auspices of American Society of Heating and Ventilating Engineers, and under management of Charles F. Roth, International Exposition Co., Grand Central Palace, New York, N. Y. E. O. Eastwood is chairman of the advisory committee.

American Society of Mechanical Engineers: Semi-annual meeting, June 16-19, Hotel Muehlebach, Kansas City, Mo. Headquarters office, 29 W. 39th St., New York, N. Y. Program includes papers on air conditioning in the flour mill, by George M. Sebree; firing of pulverized coal and other fuels together, by A. C. Foster; cooling tower progress, by L. T. Mart; and vaporization inside of horizontal tubes, by W. H. McAdams, W. K. Woods and R. L. Bryan.

National Association of Building Owners and Managers: Annual convention, June 16-19, Stevens Hotel, Chicago, Ill. Headquarters office, 134 S. La Salle St., Chicago, Ill.

American Society for Testing Materials: Annual meeting and exhibit of testing apparatus and related equipment, June 23-27, Palmer House, Chicago, Ill. Program includes symposium on problems and practice in determining steam purity by conductivity methods, and sessions on effect of temperature, fatigue of metals, corrosion, etc. Headquarters office, 260 S. Broad St., Philadelphia, Pa.

National Industrial Advertisers Association: Annual conference to be held in Toronto, Canada, at Royal York Hotel in September. Headquarters office, 100 E. Ohio St., Chicago, Ill.

"Sign of the Time—WECO-N.G.E. Series F600"

Using the RIGHT burner in the RIGHT way. There is a Webster Burner to fit the peculiar characteristics of any type heating or power boilers.

Shown here are two Webster engineered burner installations in a large Mid-west sign plant. (Left) Webster VI-2 HIGH PRESSURE INSPIRATOR installed in a 20 h.p. Scotch Marine boiler, equipped with Webster Flame Retention Type Pilostat. (Right) WECO-N.G.E. Series F600L65 gas burner installed in a No. 416 Brownell Firebox Boiler.

WECO-N.G.E. Series F600 GAS BURNERS are available for ratings from 50,000 B.t.u. to 10,000,000 B.t.u. output. This is the only burner of its type that features Multiple Port Interchangeable Grills, an Improved Type Venturi, and a Unique Baffle System.

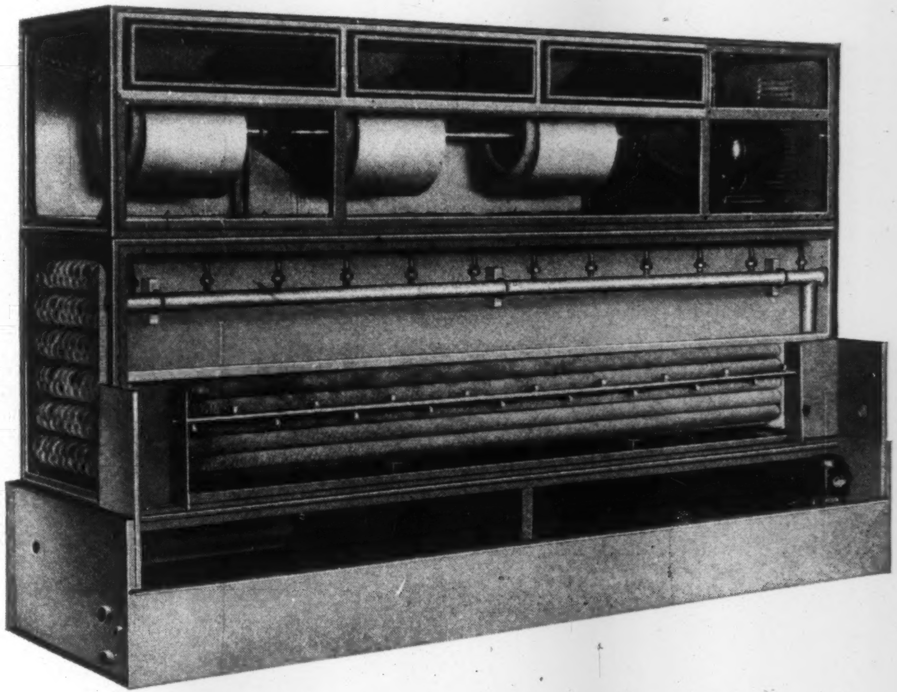
WRITE FOR SERIES F600 BULLETIN

THE WEBSTER ENGINEERING CO.

TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. . . . . Toledo, Ohio

YORK ECONOMIZERS



cut water bills for your customers

SAVE WORK FOR YOU!

Where water rates are high or the supply limited there is a size and type of York Economizer (evaporative condenser) exactly suited to the job.

These compact units, of sectional design, are easy to transport and to install in restricted space. They save 99 per cent of the city water ordinarily required for a refrigerating system.

The condenser element is of welded bare pipe, galvanized after fabrication. Non-ferrous coils are available where specified. The entire unit is designed to resist exposure and corrosion. Easily removable panels assure easy quick cleaning.

Circulation over the condenser is supplied by a low-head direct-connected pump in the base of the unit. Since no eliminators are required, low fan resistance and power consumption contribute to operating economy.

When you need maximum condensing effect in minimum space, you want a York Economizer.

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York Ice Machinery Corporation, York, Pa. Headquarters Branches and Distributors throughout the world.

YORK REFRIGERATION AND AIR CONDITIONING

"Headquarters for Mechanical Cooling Since 1885"

A FEW OF THE MANY NATIONALLY-KNOWN USERS OF YORK EQUIPMENT—*American Cyanamid • American Optical • Bendix-Westinghouse Bethlehem Shipbuilding • Bethlehem Steel • Consolidated Aircraft • Curtiss-Wright • Douglas Aircraft • du Pont • Eastman Kodak Firestone • Ford • General Motors • Goodrich • Gulf Oil • Hercules Powder • Jones & Laughlin Steel • Norton Company • Owens-Illinois • Republic Steel • Shell Oil •* **SKF** *• Socony Vacuum • Studebaker • Texas Company • U. S. Army • U. S. Navy.*

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterick (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

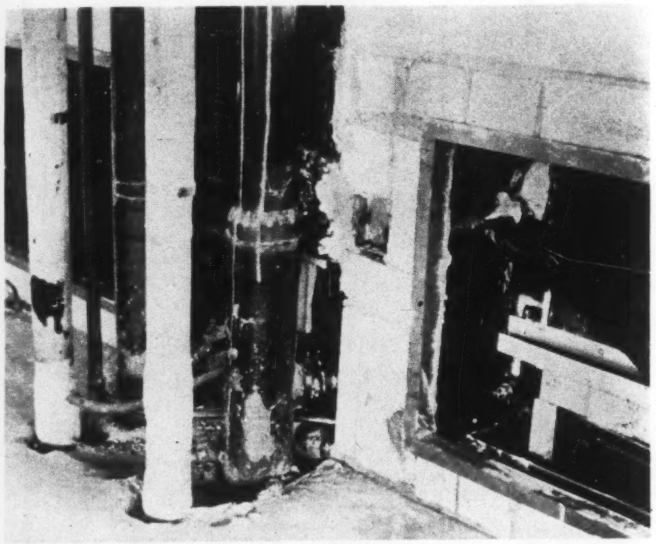
Conditioned Air Through Conduits

No. 2129—Development of a new type of air conditioning system—called the "Weathermaster Conduit System"—was announced at a Producers' Council banquet in New York City last month. The new year 'round air conditioning system requires no more floor and wall space in buildings than steam pipes for a heating system, according to Dr. Willis H. Carrier, who said that the system has already been tested and proved successful in the Bankers' Health and Life Insurance Co. building, Macon, Ga., and that installations are under way in office buildings in Charleston, W. Va., Toronto, Canada, Raleigh, N. C., and in hospitals in Peoria, Ill., and Hays, Kans.

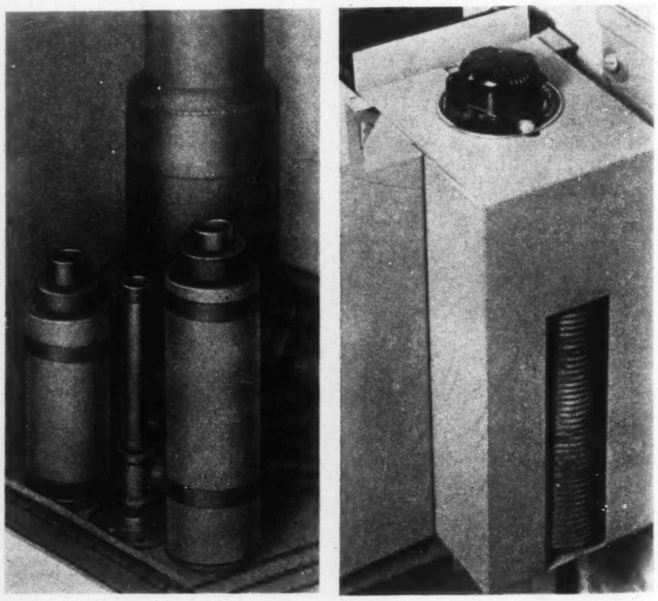
Adapted primarily to apartments, hospitals, office buildings and other multiroom structures, the new method is made possible through the discharge of conditioned air at high velocities through small conduit instead of large ducts. "Entire air conditioned cities, apartment house and office building developments are now possible through the use of the system," Dr. Carrier declared. "You can imagine yourself what this will do for the greater utility of multiroom buildings through increased comfort, health and efficiency."

Complete standardization of parts will effect a substantial reduction in the cost of engineering and installation of air conditioning systems in large buildings, it is said. "Air conditioning is no longer a 'tailor-made' job," Dr. Carrier stated. "The conduit system saves from 85 to 95 per cent of the rentable space taken up by previous systems. The saving in building space and height has been found to amount to between 20 and 30 per cent of the installed cost of air conditioning."

The development was started in 1929 when a New York architect wanted to provide a system for a tall building on a small plot of land, Dr. Carrier said. Because floor space was at a premium, the architect wanted ducts which would occupy no more floor space than



Air conditioning riser group consisting of conduit air supply, water supply, water return and drain. Flexible air branch takeoff just above floor level on conduit pipe at right. The conduit is reduced in diameter above the takeoff from 6 to 5 in.



***Left*—Model cut-away section of conduit system showing insulated pipes for hot and cold water and small drain pipe and, in rear, air supply conduit with front takeoff to room unit . . . . *Right*—Control valve on room unit. Desired room temperature is automatically maintained at selected setting on dial at top right. Thermal bulb in lower cutaway controls flow of water**

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [7-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2129 2130 2131 2132 2133 2134 2135 2136 2137 2138
2139 2140 2141 2142 2143 2144 2145 2146
3910 3911 3912 3913 3914 3915 3916 3917 3918 3919
3920 3921 3922 3923 3924 3925 3926 3927 3928 3929
3930 3931 3932

Name ....Title............
Company ....
Address ....
City ....State............

heating pipes so that they might be run by the columns between the windows in each bay.

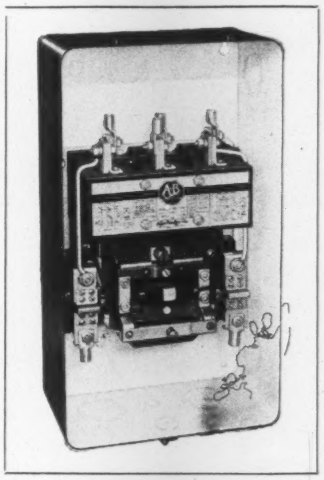
The system comprises heating, cooling, ventilating, cleaning, humidifying and air circulation equipment situated in the basement or central apparatus room. This equipment draws in outside air and properly conditions it for cleanliness, ventilation and humidification. Standardized steel conduits distribute the air to the various rooms. The air is then discharged under pressure through induction nozzles which draw large amounts of room air over the heating and cooling coil in the room "Weathermaster" units and diffuse it throughout the room. No dehumidifying is done by this room unit coil in ordinary operation, which aids in preventing odors due to condensation on the room coil.

One of the first obstacles to be surmounted was that of standardizing the connections to the unit. The system utilizes this feature to reduce installation costs. The system is composed of standard manufactured parts. The welded conduit is fabricated at the factory from flat steel sheets in floor-to-floor lengths, and is rustproofed by a special process. Ordinarily, the largest conduit size is 6½ in. and this will usually take care of 12 or 13 floors from one riser, it is stated.

Hot or cold water is circulated to the room units, and a control valve automatically determines how much water must be circulated to maintain a constant temperature in the occupied space. The cold water is first routed counterflow through the primary air cooling equipment in the apparatus room and then through the room units. —Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Solenoid Starters

No. 2130—The new "Size 4, Bulletin 709" solenoid starter has been developed to meet a demand for a larger starter with solenoid switch structure. It has a maximum rating of 50 hp, 220 volts, and 100 hp, 440-550-600 volts. According to the manufacturer, it includes all of the features of the smaller solenoid starters of the line; contact cleaning, filing or dressing is avoided by the use of cadmium silver contacts and there are no bearings, pivots or hinges.



The double break, cadmium silver contacts are totally encased in an arc hood, each pole of the switch having its individual arc chamber. Hence, these starters can be closely grouped without danger of flash-over between switches, it is stated.—Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.

Side Inlet Steam Traps

No. 2131—New additions to a standard line of side inlet steam traps are available in capacity ranges of 800-100, 1600-2000 and 3000-4400 lb per hr. All feature the basic body design which has been used by the manufacturer for several years for side inlet traps.

THE IDEAL HEATING SYSTEM

Whether you install Unit Heaters in plants manufacturing aircraft, motors or other vital materials for national defense —America's "all-out" production schedules will be stepped up appreciably if the plants are comfortably heated this fall and winter.

Heating engineers and contractors have found this ideal heating system in the WING Unit Heater with the *slowly revolving* outlets.

This method of thoroughly distributing heat eliminates constant, sickening blasts of hot air and brings a sensation of fresh, live invigorating warmth to workmen. This sensation was never experienced prior to the advent of the WING Revolving Unit Heater.

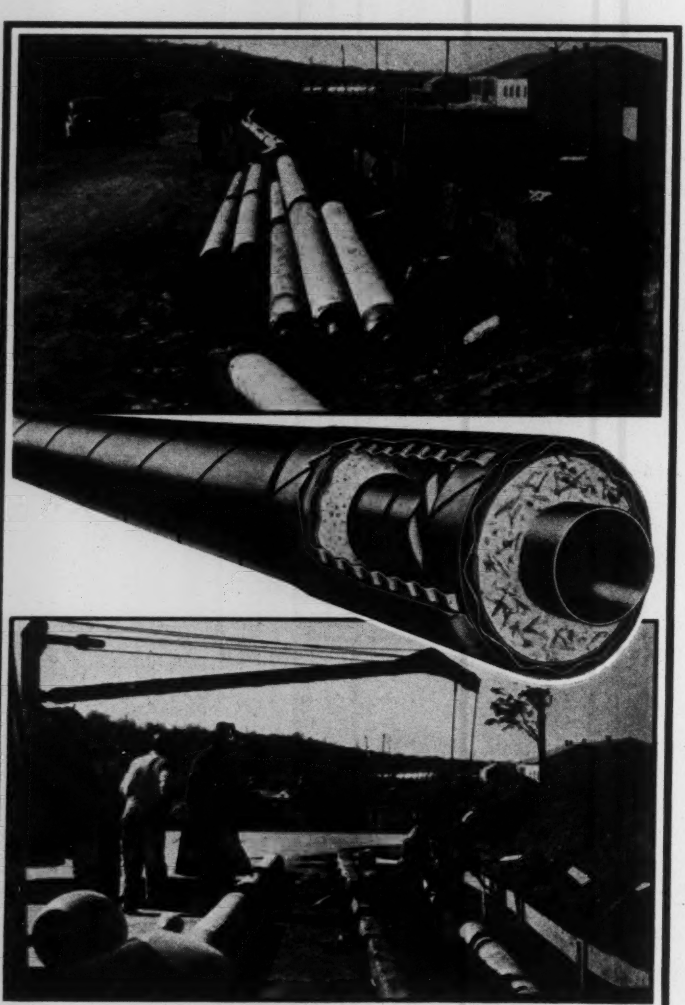
WING engineers will gladly assist you in the proper design to fit your individualized applications . . . or write for *new* Bulletin HR-1.

L. J. WING MFG. CO.
14th St. & 7th Ave., New York, N.Y.

Wing Revolving Unit Heaters in Repair Shop of North Coast Transportation Co., Seattle, Wash.

Wing Revolving Unit Heaters in Plant Manufacturing Airplane Motors.

WING REVOLVING DISCHARGE UNIT HEATERS



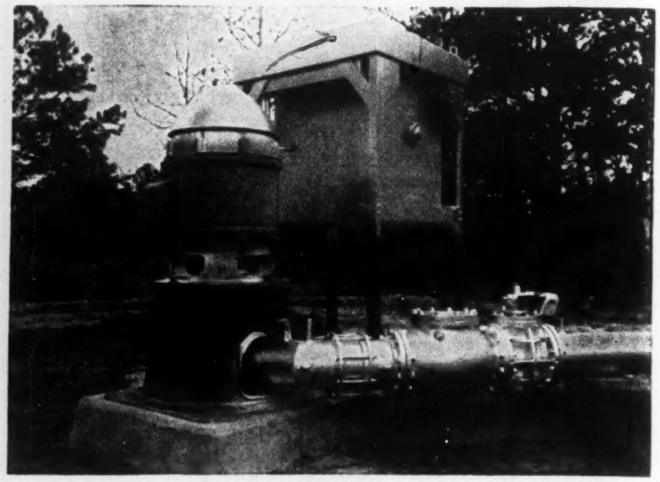
RIC-WIL

INSULATED PIPE UNITS "ON THE JOB" AT BOLLING FIELD

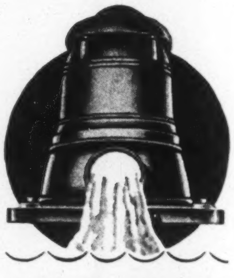
Situated at Anacostia, D. C., four miles south of our National Capitol, Bolling Field has now become the new headquarters for the U. S. Army Air Corps. On this job 10,526 lineal feet of Ric-wiL Insulated Pipe Units with Dry-paC Insulation were installed for the protection of underground steam piping. This order was received by Ric-wiL on February 1st of this year, and by February 17th, or two days ahead of contract delivery date, shipment was completed. Our record on this outstanding project exemplifies the speed and competence which Ric-wiL is equipped to contribute to any defense problem involving underground steam distribution. Write for Brochure 4112 on Bolling Field installation.

RIC-WIL CONDUIT SYSTEMS

The RIC-WIL COMPANY
CLEVELAND · OHIO
Agents in Principal Cities



Better Put In Your Own WELL WATER SUPPLY



A NATIONAL emergency exists! You have been called upon to "keep your wheels turning"—and production at its peak. A water shortage, or failure would play havoc with your program. Save time, worry and possible shut down by putting in your own Well Water System.

Select the most dependable system made. That means Layne. Select it for its proven reputation of highest efficiency, unquestionable quality and outstanding engineering features. Select a Layne Well Water System because the Layne organization has the men, equipment and skill to do the job complete and right, in the shortest possible time—anywhere in the United States or possessions.

Layne Engineers will cooperate gladly in making a survey of your water supply needs. They are qualified specialists in Well Water Supply problems, and will collaborate with you, your engineer or plant superintendent. There is no obligation.

AFFILIATED COMPANIES

LAYNE-ARKANSAS CO. . STUTTGART, ARK.
LAYNE-ATLANTIC CO. . . . NORFOLK, VA
LAYNE-CENTRAL CO. . . MEMPHIS, TENN.
LAYNE-NORTHERN CO., MISHAWAKA, IND.
LAYNE-LOUISIANA CO. LAKE CHARLES, LA
LAYNE-NEW YORK CO. . NEW YORK CITY AND PITTSBURGH . . . . . . PA
LAYNE-NORTHWEST CO. MILWAUKEE, WIS
LAYNE-OHIO CO. . . . COLUMBUS, OHIO
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LAYNE-WESTERN CO., KANSAS CITY, MO CHICAGO, ILL. . . . OMAHA, NEBRASKA
LAYNE-WESTERN CO. OF MINNESOTA MINNEAPOLIS . . . . MINN.
LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . MASSACHUSETTS
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . ONTARIO, CANADA

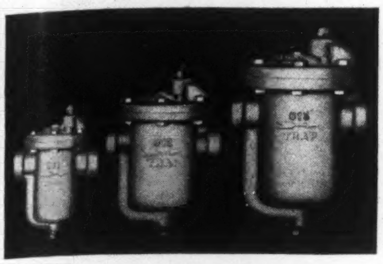
"For Defense" is a new bulletin just issued which pictures and lists defense work completed for air fields, army camps, munition plants, etc., by Layne. It is free. Address

LAYNE & BOWLER, INC.
Memphis, Tenn.

LAYNE

PUMPS & WELL WATER SYSTEMS
For Municipalities, Industries, Railroads, Mines and Irrigation

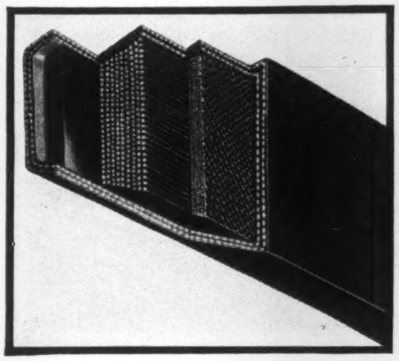
Advantages claimed for this design include: (1) trap cap carrying complete mechanism can be removed without disturbing pipe connections; (2) leaving the trap body permanently in the line obviates any necessity of ever having to handle a vessel filled with hot condensate or having to reprime the trap after such occasions; and (3) installation convenience where it is practical to use horizontal, straight through pipe connections.



All of the new traps are built for operation on pressures up to 250 psi ga. They are equipped with standard stainless steel inverted bucket operating mechanism. Available with blast type thermic air vent buckets and internal type check valves as optional extra equipment.—Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.

Improved V Belts

No. 2132—Announcement was made last month by a pioneer in the field of multiple v belt transmission that all its "Texrope" v belts are now of the new "Super 7" laminated design, based on the Vogt formula and abundant field experience, to include "more strength and flexibility, greater service and longer life." The cords in the new belts are smaller, permitting the use of more cords per belt with a resulting greater strength and less stretch, it is stated. Each cord is individually imbedded in heat dissipating rubber to reduce internal belt degeneration.



These belts are made in matched sets to assure uniform, smooth running, efficient drives. Each element of the belt is designed to fulfill an individual function; the live rubber bottom cushion absorbs the impacts of operation, the central cord portion transmits power at the effective pitch diameter, and the bias cut fabric prevents "dishing" and assures transverse stability. The two ply rubber impregnated fabric cover prevents destructive agents from reaching the vital belt elements, resulting in a high grip coefficient between belt and sheave walls, according to the manufacturer.—Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Fans and Blowers

No. 2133—The Herman Nelson Corp., 2nd St., Moline, Ill., has announced that it purchased on July 1 the assets and business of the Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill. The business will be operated as the Autovent Fan & Blower Div.

The complete line of Autovent products will continue to be manufactured in the Autovent Div. in Chicago.

Asbestos Protected

DUX-SULATION

for SOUND ABSORBING AND INSULATING, HEATING, VENTILATING AND AIR CONDITIONING DUCTS

Meets New Needs!

If you, too, are using black iron sheets for duct work, it is all the more important that the ducts be protected with Dux-Sulation to prevent them from rusting. To apply Dux-Sulation the entire duct is coated with a Rubber Base Cement which serves not only as the adhesive for holding the insulating felt in place but as a protective coat for the metal as well.

Has These Superior Features

Dux-Sulation has a 75% insulating efficiency (K factor .27 B.T.U.) . . . High Sound Absorbing efficiency (70%) . . . Low Frictional Resistance . . . Prevents Condensation . . . Will not rot, chip or flake . . . Easiest Insulation to apply and looks best . . . Comes Complete, nothing else to buy . . . Is easy to handle in stock or on the job . . . Each roll contains 100 sq. ft. of standard 1/2" thickness.

When you have insulated your ducts (either galvanized or black iron) with Dux-Sulation you get the utmost in operating efficiency at a minimum cost. "It pays for itself."

Write office nearest you for details

GRANT WILSON, INC.
4101 West Taylor Street CHICAGO
PLANT RUBBER & ASBESTOS WORKS
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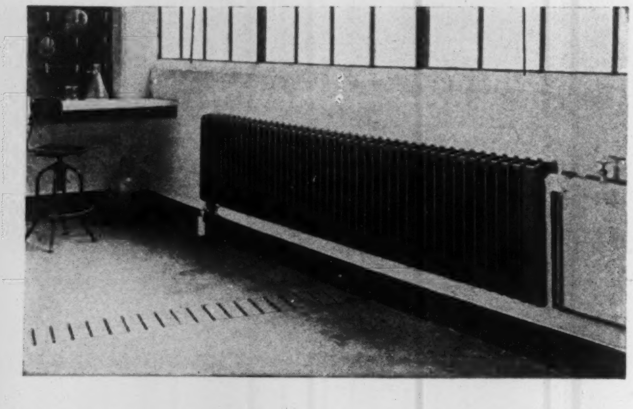
8 West 40th Street NEW YORK
ATLAS ASBESTOS CO., LTD.
110 McGill St. MONTREAL, CANADA

Attractive . . .
SHAW-PERKINS

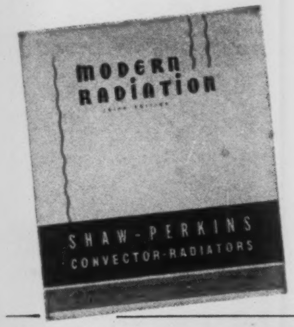


HEATING UNITS

THE attractiveness of an installation is really just as important as its efficiency. The day of the ugly, inefficient, dust-catching radiator is past and you'll find a definite demand for the trim, compact Shaw-Perkins Radiator.

These modern heating units combine all the advantages of unit heaters, convectors and radiators. They will move air with about the same facility of a unit heater, still delivering the correct proportion of radiant heat. Able to operate on high or low steam pressure or forced circulation hot water, they permit smaller heating units and consequently less costly installations.

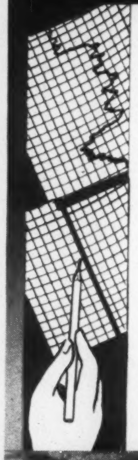
Investigate further — drop us a line today.



WRITE TODAY
FOR A COPY
OF THIS
FREE BOOKLET

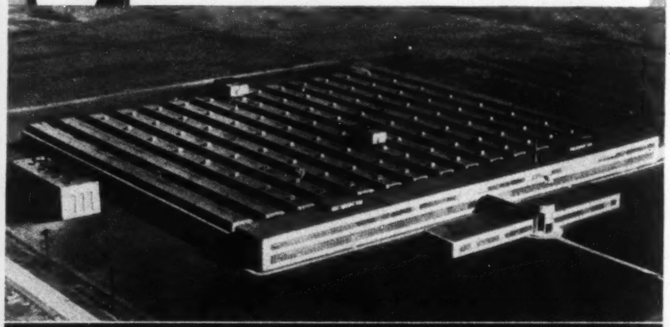
SHAW-PERKINS MFG. CO.
Oliver Building
PITTSBURGH, PENNSYLVANIA

Because
KATHABAR
AIR CONDITIONING
IS *Different?*



● SHOCK, CHILL and CLAMMINESS have been eliminated from the great modern defense plant of The Curtiss-Wright Corporation, Curtiss Propeller Division, at Caldwell, New Jersey, one of the many factories now equipped with Kathabar, establishing the new accepted standard for air conditioning in modern industry.

Dependability, accurate control and low operating and maintenance costs, and day-by-day operation without interruption are assured by Kathabar's inherent different principle and proved efficiency. With Kathabar, creation of the desired atmosphere in any space is merely a matter of adjusting two simple controls governing the activity of Kathene, the non-explosive, non-inflammable element that makes Kathabar different.



KATHABAR

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1. Outside air comes in contact with the Kathene liquid by means of a Kathabar "Contactor."
HUMIDIFICATION or DE-HUMIDIFICATION is in direct proportion to the temperature of the Kathene . . . a temperature which is automatically controlled to add to or absorb the humidity as desired. This method of control is extremely accurate and very simple in operation.
2. The humidity-controlled air passes from the Kathabar Contactor to heating or cooling elements for TEMPERATURE CONDITIONING.
3. The completely conditioned air enters the comfort area or processing application as the PERFECT ATMOSPHERE.

Investigate Kathabar! Write for descriptive data today.

"TAILOR MADE"
for the
difficult jobs of
AIR CONDITIONING

KATHABAR
A PRODUCT OF
SURFACE COMBUSTION
TOLEDO, OHIO SC CORPORATION

Included in the line are a complete range of sizes of centrifugal blowers from 6 in. to 72 in. in diameter in both forwardly and backwardly curved blade designs, and a complete selection of propeller exhaust and ventilating fans from 12 in. to 72 in. in diameter.

New V Belt

No. 2134—A new type of v belt, with a unique driving surface for either flat pulleys or v grooved pulleys, is being marketed under the name of "Dayton Cog-Belt." It is designed around a new type of cog construction principle on the inner surface of the belt, the maker states. Not only does this construction provide greater flexibility and longer belt life when flexing around small pulley diameters, but for v flat drives it applies the scientific principle of increasing traction by means of a non-skid design, it is stated.

Just as scientific tire tread design prevents slipping on smooth roads, so does the patented cog construction provide greater grip and less slip on smooth flat pulley surfaces, according to the manufacturer. Likewise, when riding in grooved pulleys, this new belt provides a greater gripping power with die cut raw edge sides which present undistorted driving surface to the pulley regardless of side wear.

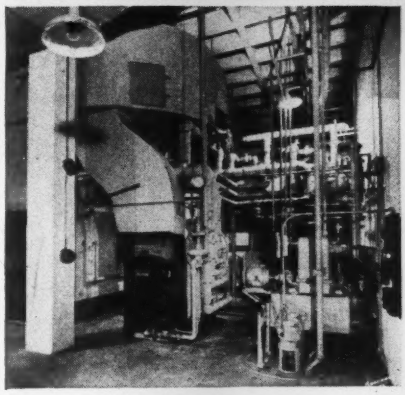
This new belt is being manufactured in all standard lengths in A, B, C, D and E cross-sections, and in matched sets for multiple drive service.—The Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, Ohio.

Unit Heaters

No. 2135—A new projector unit heater for vertical downward delivery is recommended by the maker for use in buildings having high ceilings. It is not intended to supersede the standard type but rather to supplement it to give the best results. Deflector cones are standard equipment for even heat distribution and where wider horizontal distribution is required with even lower vertical velocity, "Anemostat" deflectors are provided as deluxe equipment.

The heating element is guaranteed by the manufacturer for operating pressures up to 150 psi. Horizontal seamless copper tubes are brazed into seamless headers to make the entire element one homogeneous unit.

MATERIALS, MEN, METHODS...all three contribute to INSULATION EFFICIENCY



←

FEDERAL BUILDING, Kansas City, Missouri. Boilers and piping insulated with 85% Magnesia blocks and pipe covering. Hot and cold water lines, Ruberoid Woolfelt. *Architect,* Wight & Wight, Kansas City, Mo. *General Contractor,* Swenson Construction Co., Kansas City, Mo. *Plumbing and Heating Contractor,* Interstate Heating Co., Kansas City, Mo. *Insulation Contractor,* Kansas City Insulation Co., Kansas City, Mo.

RU-BER-OID SUPPLIES ALL THREE!

Proper products to meet each specific problem. *Hand-picked men* skilled in insulation application. *Sound engineering counsel* to accomplish maximum results at minimum cost. These are the three important factors to insure real insulation efficiency for heating, cooling and air conditioning. Ruberoid supplies all three on every job.

Materials. The Ruberoid line of insulation is complete. It includes pipe coverings and blocks for temperatures from 350° to 1600°F; Woolfelt pipe covering for hot or cold water conduits; asbestos papers for wrapping furnace pipes, protecting air conditioning; specialties such as high temperature cements, millboard, roll board, rock wool bats and blankets.

Men. Throughout the country Ruberoid has Approved Applicators—organizations known and respected for their knowledge of insulation and careful workmanship. These applicators are hand-picked, able, well-qualified to serve you. They are of the highest type in the industry.

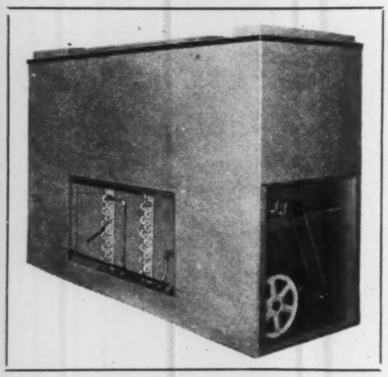
Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

Get All Three. On the next job get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for Ruberoid's latest Insulation Catalog. Invaluable as a reference guide. Address The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Dept. HPC-7.

RU-BER-OID
Insulation
Reg. U. S. Pat. Off.
For HEATING · COOLING · AIR CONDITIONING

These units are available in a complete range of capacities from 30,000 to 400,000 Btu per hr with motors ranging from 1/20 to ¾ hp.—Beacon-Morris Corp., 702 Beacon St., Boston, Mass.

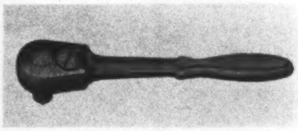
Air Conditioning and Dehumidifying Unit



No. 2136—A new unit for humidity control and air conditioning, called the "Calorider," has recently been developed to dehumidify, filter and cool air, and to humidify it in winter. It uses a patented moisture absorbing chemical ("Caloride") through which air is drawn by means of a motor driven fan. The incoming air passes through coils, which are sprayed with liquid, and then comes in contact with liquid coated lumps, thus being subjected to countless impacts upon highly viscous surfaces which remove odors, dust and pollen, according to the maker. The medium for cooling is water, and satisfactory results may be obtained with water up to 75 F.

The unit is encased in an all metal cabinet and will deliver up to 1500 cfm of air. Two smaller portable units deliver 100 and 250 cfm, respectively.—General Air Conditioning Corp., 4411 Appleton St., Cincinnati, Ohio.

Ratchet Wrenches



No. 2137—A midget pattern reversible ratchet ha been added to the manufacturer's "Supersocket" line, i was announced last month. The tool, which has a ¼ in square drive, is 4½ in. long and incorporates the same patented double tooth pawl for both on and off rotation as is used in the other "Superratchet" wrenches.

A convenient shift lever reverses the wrench actio instantly. The handle is drop forged from high tensil carbon steel, and working parts are machined fro chrome molybdenum steel and are heat treated.—J. H. Williams & Co., 225 Lafayette St., New York, N. Y.

Hot Water Treatment

No. 2138—A unit for the treatment of hot water in order to prevent and remove scale, to stop corrosion and pitting, and to provide a desirable quality of soft water, has recently been developed. It is a bi-metal device, cylindrical in design, from 2½ to 5 in. in diameter, and from 6 to 18 in. in length—the various lengths being provided in order to simplify and make proper sizing for any specific job convenient. The unit comprises an outer shell of copper and an inner unit or element made of a combination of "sacrificial" metals which, according to the manufacturer, gradually dissolve and disintegrate under the attack of impurities in the water which would otherwise attack the boiler lining and tubes to form scale or corrosion. There are no moving parts.

Distinctive Advantages Announced for the new

Eclipse

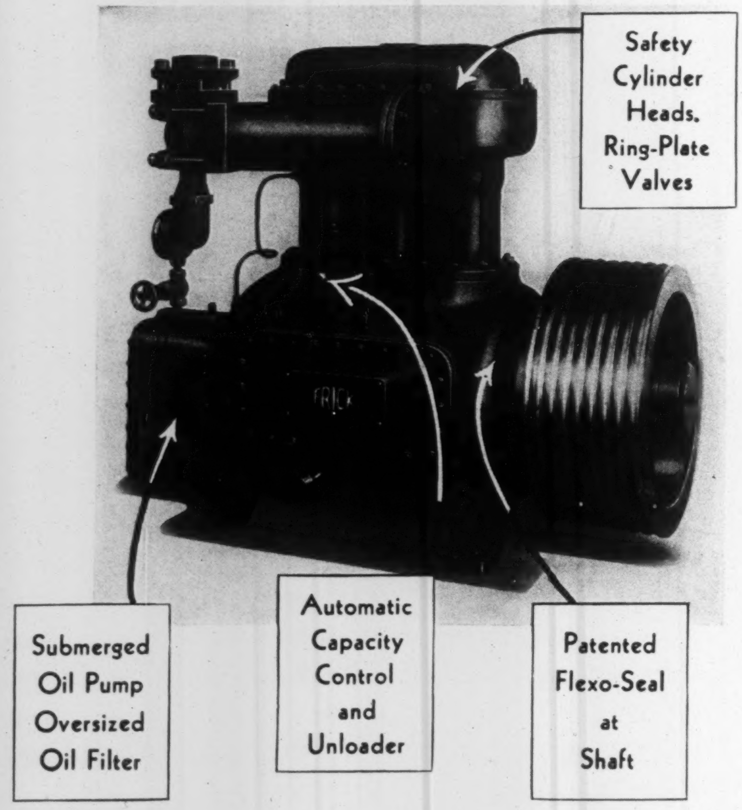
Refrigerating Machines

Don't buy ANY Freon-12 compressor until you've seen the new Frick Eclipse line! Built in three sizes, these phenomenal machines give capacities up to 60 tons refrigeration . . . in units so compact, light, efficient, and quiet they can be installed almost anywhere . . . and at a material saving over older types!

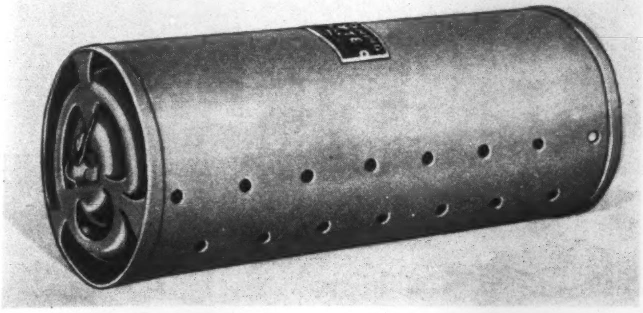
Only in the Eclipse line can you get all the exclusive advantages shown, plus such features as higher operating speeds (up to 900 r.p.m.), force-feed lubrication throughout, direct-connected motor drive when desired, two machines operating together (using the Frick oil-equalizing system), pistons with 5 rings, etc., etc. Nearly 60 years' refrigerating experience built into them.

Write, wire or phone your Frick Branch or Distributor for full details today. Or, get in touch with

DEPENDABLE REFRIGERATION SINCE 1882
FRICK Co.
WAYNESBORO, PENNA. U.S.A.


Safety Cylinder Heads. Ring-Plate Valves
Submerged Oil Pump Oversized Oil Filter
Automatic Capacity Control and Unloader
Patented Flexo-Seal at Shaft
FRICK

The installation is accomplished by placing the proper sized unit in the hot water, either by laying it across boiler tubes, placing it in the receiving drum and mud drum of water tube boilers, placing it in the hot water circulating line of domestic hot water systems or suspending it in the hot water storage tank. It operates, says the manufacturer, on a modification of the principle that by reversing the polarity of a given metal normally susceptible to scaling action, it will become free of and immune to scale and corrosion.—Electrolyte Mfg. Co., Sandwich, Ill.



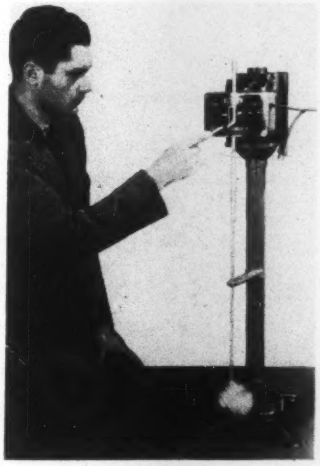
Gas Valve

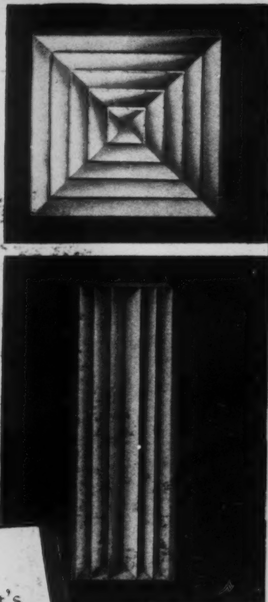
No. 2139—The "Thermo-Draulic" gas valve has been developed to regulate the gas flow to a burner under the control of a room thermostat or other device. The valve disc is opened by an expanding liquid in the element, this liquid being heated by an external coil which is energized by the controlling instrument. A safety feature is that in case of power failure or damage to the wiring, the valve will return to the closed position.

Models are available for a-c or d-c power supply, low or line voltage, and with or without manual opening and automatic recycling features.—Perfex Corp., 500 W. Oklahoma Ave., Milwaukee, Wis.

Sump Pump

No. 2140—The addition to a rapidly growing pump line of a sump pump for automatic removal of seepage, overflow, drainage and floodwater from elevator pits, boiler pits, cellars, etc., has been announced. According to the manufacturer, it has a capacity of 2200 gph at 2 ft head, and 1800 gph at 10 ft head. Of the centrifugal type, the unit is 38 in. high and weighs 58 lb. It is driven by an induction type ¼ hp motor. Features include a flow adjustment, made by the





Will Your Specifications Call for LAZY AIR or AGITAIR?

Take a Tip From Ford:

Active air means active men. That's why designers of defense projects like the new Ford Magnesium Foundry specify AGITAIR Type "R"—the only diffuser that provides complete control of air distribution.

MORE and more plants are turning to AGITAIR Type "R" for ideal air distribution. It insures worker comfort and efficiency because it assures a continuous flow of fresh, invigorating, active air. No drafts . . . no stale air . . . no hot and cold spots.

HERE'S THE SECRET OF AGITAIR—

Greater Turbulence in the Primary Air Stream . . . from 64 independent air streams per sq. ft. That's why you get correct air distribution with AGITAIR. That's why we say—64 air streams are better than 1.

THE ONLY COMPLETE LINE OF AIR DIFFUSERS FOR BOTH CEILING AND SIDEWALL DISTRIBUTION.

A SHAPE, SIZE, TYPE, AND MODEL FOR EVERY INTERIOR

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WHEN YOU SPECIFY AIR DIFFUSERS — REMEMBER THESE

AGITAIR ADVANTAGES

- √ Easily dampered with directional louvres.
- √ Simpler to install—lighter. Smaller overall dimensions.
- √ Greater diffusing ability—greater turbulence from 64 independent air streams per sq. ft.
- √ Diffusion pattern control in sizes from 6" x 6" to 9' x 9'.
- √ Square or rectangular to match the straight lines of plant design.

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TEMPERATURE EQUALIZER
AIR DEVICES, Inc.
17 East 42nd St., New York, N. Y.
Specialists in Air Distribution and Control
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Air Devices Inc.
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Gentlemen: Please send me Catalog "R". Also complete information on "Diffusion Pattern Control".
Name
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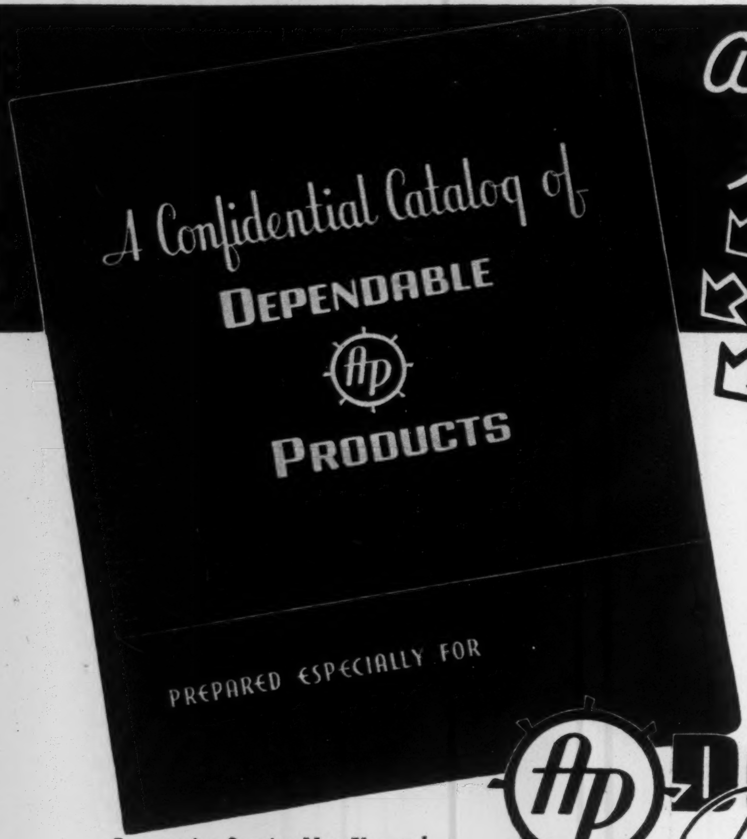


Ask Your Jobber to show you THIS BOOK!

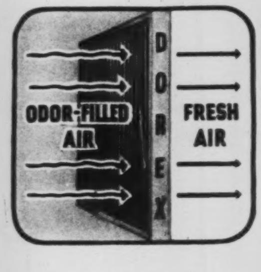
This unique book, the first of its kind in the industry, shows the step by step construction of the "Dependable" A-P Expansion Valve. It will be worth your time to see this interesting demonstration at your jobber's store. Building the valve before your very eyes it conclusively proves the many reasons for A-P "Dependability."

AUTOMATIC PRODUCTS COMPANY
2460 North 32nd Street • Milwaukee, Wisconsin

AP DEPENDABLE Refrigerant Valves

Progressive Service Men Use and Recommend — and Aggressive Jobbers Stock and Talk — AP Products.

FOLLOW YOUR NOSE TO PROFITS



. . . It's as simple as that. Because there's a Dorex solution to every odor problem, there's a potential profit for you.

Dorex package units—each self-contained and designed for a specific job—are the answer to the odor menace in restricted areas. And larger Dorex Odor Adsorbers are available for installation in the air conditioning system, making possible substantial savings in equipment costs and operating expense due to the reduction effected in outside air requirements.

Highly activated Dorex coconut shell carbon is the medium which, by adsorption, extracts and permanently holds odors before they get in their licks at industrial and employee health. Odor-laden air is circulated through the carbon and returned odor-free. Built-in motor driven fans provide the circulation in Dorex package units; in larger installations, the air conditioning system blowers are adequate due to Dorex low resistance. The life of activated carbon depends upon odor intensity of course, but will average from 6 months to two years. Upon saturation, the carbon may be inexpensively reactivated and used repeatedly.

By following your nose, you will show your customers the way to profits, too, for odors can do greater damage than you think. Bulletin H-7 cites a few examples and tells how Dorex coped with the problems; also contains complete data and photographs of Dorex package units. Another bulletin explains what Dorex Odor Adsorbers mean to air conditioning and gives vital facts and figures on savings. Either or both are available on request. WRITE FOR YOURS TODAY!

DOREX
DOREX

"WORKS LIKE A GAS MASK"

DOREX

Reg. U. S. Pat. Off.

ODOR ADSORBERS

DOREX DIVISION

W. B. CONNOR ENGINEERING CORP.

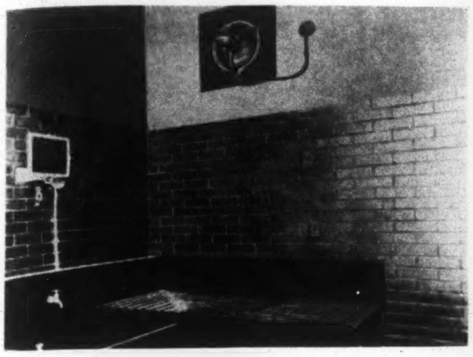
114 East 32nd Street, New York, N. Y.

FOR ODOR-CONTROL IN AIR CONDITIONING, COMMERCIAL VENTILATION AND INDUSTRIAL PROCESSING

turn of a thumb screw, and a completely encased toggle switch and large copper hollow float for assuring positive automatic operation.—Eastern Engineering Co., 45 Fox St., New Haven, Conn.

Dark Room Ventilator

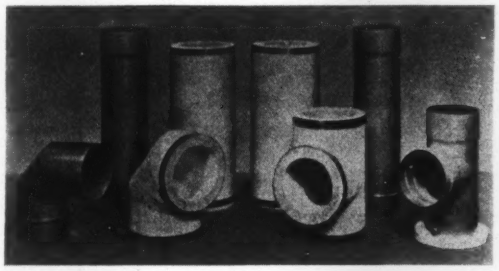
No. 2141—A new small size dark room ventilator, known as the "Ilgvent," is offered for use in small commercial studios or homes. It has a capacity of 350 cfm. The unit is composed of a standard self-cooled motor propeller-fan, mounted in a steel panel, a scientifically designed baffle or hood to prevent introduction of light without restricting air flow, and a fan guard. The ventilator can be operated on a light circuit by means of a common extension cord and plug.



In addition to this model, two larger sizes are available, the "Ilgette" with a capacity of 450 cfm, and the 12 in. "Ilgair" of 750 cfm capacity.—Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.

Flue Piping

No. 2142—Experiments conducted by the manufacturer have indicated that when porcelain enameled flue pipe is well insulated, it can be used as a complete outlet or vent pipe for small commercial and residential space and water heating installations. Thus, the erection and maintenance of a standard masonry chimney is eliminated and interior floor space is saved.



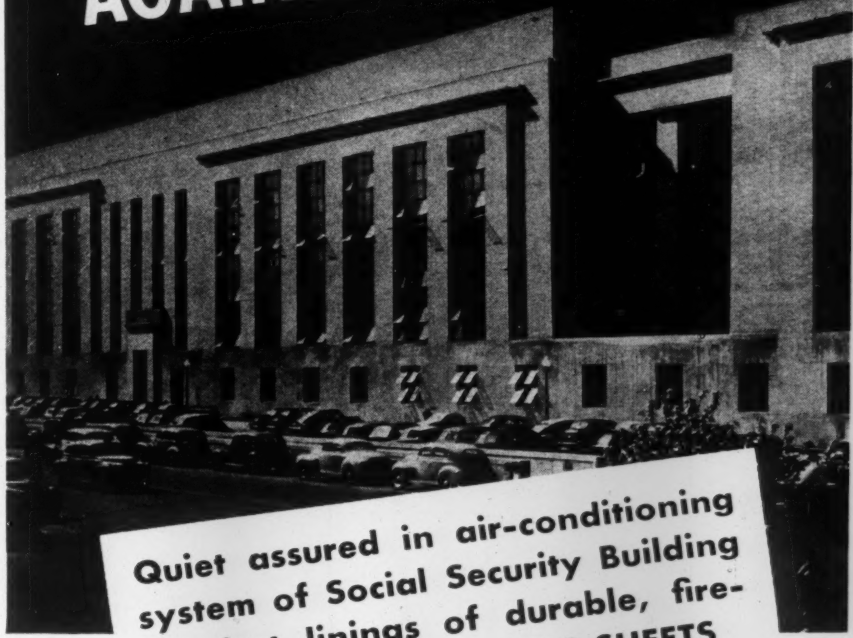
The insulated porcelain enameled pipe with "Fyrex" insulation is known commercially as "Vitroliner" vent pipe. It consists of sections of vitreous enameled pipe and fittings insulated with a high temperature prefabricated asbestos wall 1 in. thick, the outer surface being coated with refractory cement. Such pipe has been used for some years as a new or replacement lining for standard chimneys.

The pipe is made from heavy gage "Armco" ingot iron in 6, 12 and 24 in. lengths, with diameters ranging from 3 to 10 in. The acid resisting porcelain enamel was developed especially to meet the hazards of the products of combustion.—Condensation Engineering Corp., 2515 S. Archer Ave., Chicago, Ill.

Explosion Proof Motor

No. 2143—A new design of explosion proof motor is constructed to meet the specifications and carry the label

SECURITY— AGAINST DUCT NOISE



Quiet assured in air-conditioning system of Social Security Building by duct linings of durable, fire-safe J-M AIRACOUSTIC SHEETS

NOISE in air-conditioning ducts can never become a serious problem in the Social Security Building, Washington, D. C. Throughout the entire system, quiet was assured by specifying J-M Airacoustic Sheets for duct linings.

This modern lining material absorbs up to 70% of all sound that strikes it . . . preventing noise from traveling through the system from one office to another. And systems are safer, too! Basically mineral, J-M Airacoustic Sheets *will not support flame* . . . can never contribute to the spread of fire. And their unusual resistance to moisture offers protection against humidity . . . keeps maintenance at a minimum.

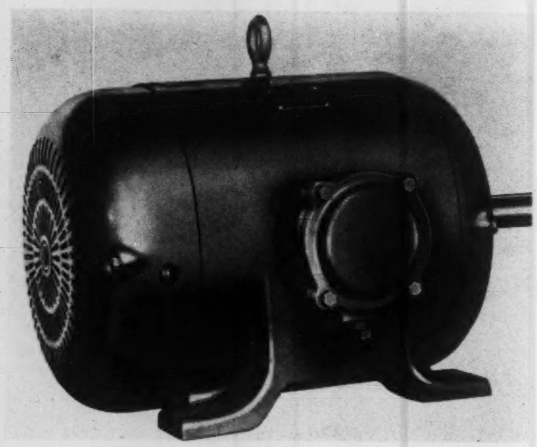
You can use J-M Airacoustic Sheets for lining any type of duct. They are light and easy to handle . . . simple and economical to apply. For details, write for brochure AC-23A. Johns-Manville, 22 East 40th Street, New York, N.Y.

LARGE, LIGHT-WEIGHT UNITS make Airacoustic Sheets easy to handle. Installation is fast and economical.

JM Johns-Manville

AIRACOUSTIC SHEETS FOR DUCT LININGS

of Underwriters' Laboratories, Inc. for Class I, Group D installations—where the surrounding atmosphere is charged with explosive quantities of acetone, alcohol,



gasoline, lacquer, naptha, natural gas, petroleum or solvent vapor—the maker states.

According to the manufacturer, the motor is constructed to resist the pressure of an explosion of any of these gases should one occur inside it, and not cause an explosion in a similar atmosphere outside the motor.—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Industrial Oil Burner

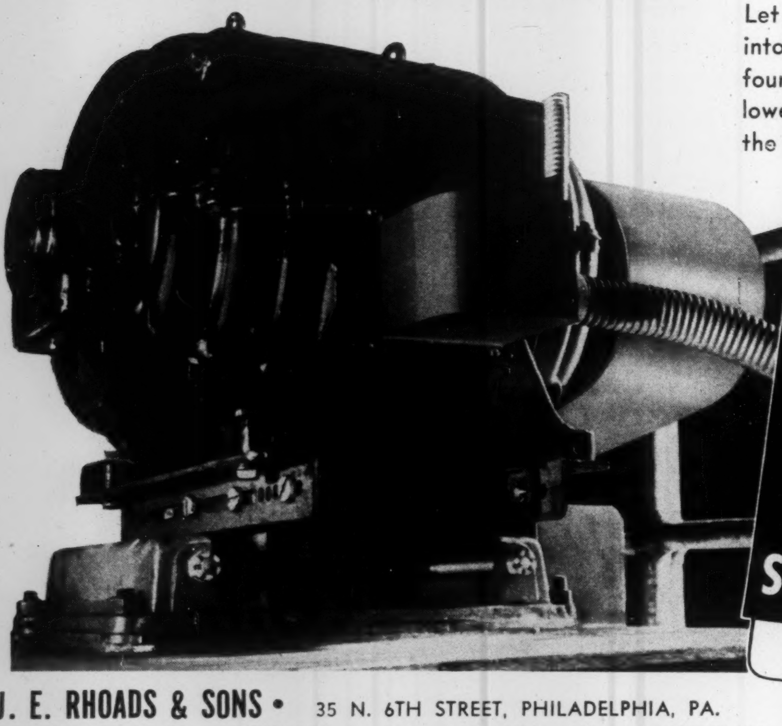
No. 2144—Primarily designed for high temperature industrial application, the new "Model LF Yellow Flame" oil burner is available in single and dual nozzle types in capacities ranging from ½ to 14 gph of oil. Applications include cooking kettles, kilns, bake ovens, annealing furnaces, drying ovens, industrial boilers, incinerators, foundry torches and similar uses, the maker states.

The unit is compact in size, being less than 1 ft high and 6 in. in depth. It will burn Nos. 1, 2, 3, 4 and light grades of No. 5 oil. Air atomizing nozzle makes possible flexibility of capacity. All parts are available for inspection or adjustments by removing cover.

Ignition is provided by 10,000 volt transformer and nickel chromium electrodes. Single burner heads or batteries of units may be used.—Electrol, Inc., 934 Main Ave., Clifton, N. J.

Valve for Governors and Gages

No. 2145—For dampening the pulsation of boiler plant pump governors and to eliminate "jitters" of the gage hand, a novel device known as the "Micro-Bean" has been developed. It can be installed on the pressure line



MAXIMUM FLOW OF POWER—
UNIFORM MACHINE SPEEDS

Higher hourly production . . . more uniform work . . . less spoilage . . . reduced unit cost . . . more profits . . . all are the assured advantages of the TANNATE-Rockwood pivoted motor base drive.

Let us show you how TANNATE-Rockwood drives fit into your production plans. A great many firms have found them an excellent way to obtain better drives at lowered costs. A note on your letterhead brings you the help of RHOADS' experience.

For PRODUCTION without INTERRUPTION
RHOADS
Established 1702
Tannate-Rockwood
the ideal
SHORT CENTER DRIVE
AUTOMATICALLY MAINTAINS CORRECT BELT TENSION

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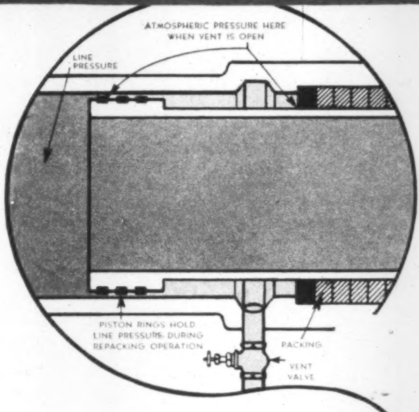
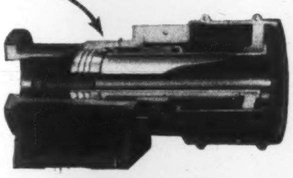
NEW YORK • CHICAGO • ATLANTA • CLEVELAND

ADSCO PISTON-RING EXPANSION JOINT

Can be REPACKED UNDER PRESSURE without Service Interruption


ATMOSPHERIC PRESSURE HERE WHEN VENT IS OPEN
LINE PRESSURE
PISTON RINGS HOLD LINE PRESSURE DURING REPACKING OPERATION
PACKING
VENT VALVE

Piston rings hold the line pressure when the vent chamber is opened to atmosphere, thereby relieving the stuffing box of all pressure, permitting the complete removal of all packing without shutting off steam.



The ONLY Slip Type Joint which Can be UNPACKED UNDER PRESSURE

This exclusive piston ring feature enables you to remove ALL the packing and insert a complete set of NEW packing rings without interruption to service when infrequently necessary to repack this joint.

This is but the latest of many ADSCO improvements in slip type expansion joints during the past 60 years.

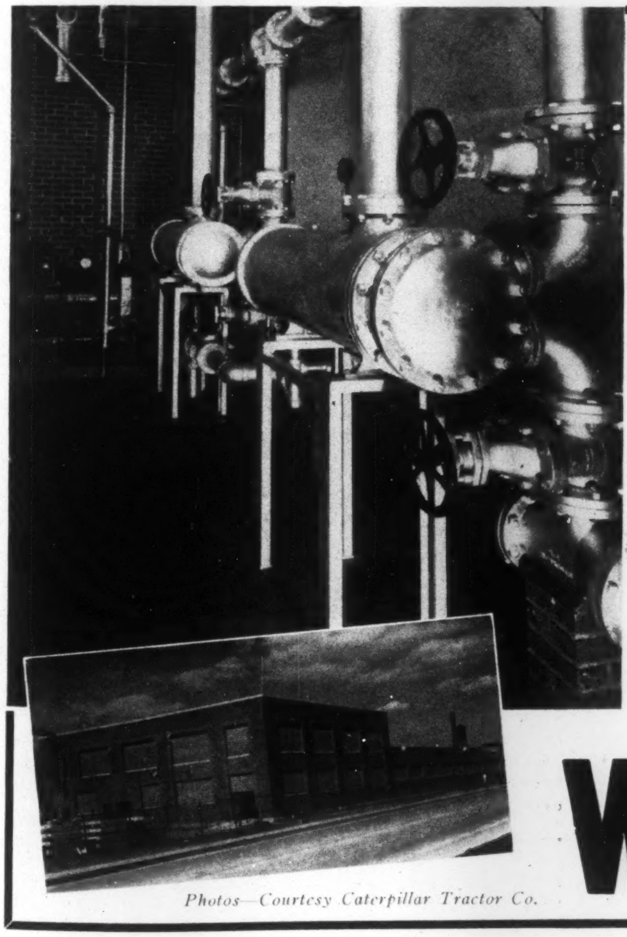
Equally important for dependable joint operation are these ADSCO features—correctly proportioned stuffing boxes; polished slips of time-tested material for ease of movement; positive limit stops prevent overtravel of slip; practical internal and external guides for proper alignment and pressure fittings for replacing lubricant in the packing thereby keeping it pliable and prolonging its life.

You get all of these features in ADSCO Slip Type Expansion Joints at no price premium over comparable types of joints.

Write for ADSCO Catalog No. 35HP.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS



Photos—Courtesy Caterpillar Tractor Co.

"Caterpillar" chooses Whitlock Instantaneous Heaters

Designed for the comfort and convenience of their foundry employees the new "Caterpillar" Employees' Service Bldg. shown is widely regarded as a model among such structures.

Wisely enough, when it came to the choice of heaters to supply hot water for the 80 showers and battery of 9 wash fountains two WHITLOCK Instantaneous Heaters were installed and connected to large storage tanks—guaranteeing ample hot water and efficient operation for years to come.

Similarly, WHITLOCK HEATERS have been chosen for schools, colleges, hospitals, hotels and apartments, clubs, laundries, and office buildings.

Bulletins, complete with engineering data, free for the asking.

THE WHITLOCK MANUFACTURING CO.

44 South Street, Elmwood, Hartford, Connecticut
District offices in New York, Boston, Chicago, Philadelphia, Detroit, Richmond

WHITLOCK

1941
JULY
1941
SUN MON TUE WED THUR FRI SAT

A Word About Deliveries:

Recently about 70% of our production facilities have been taken for Defense Work—Aircraft, TNT, Small Arms Ordnance, Bomber Assembly, Aircraft Engine Plants, Army Cantonments, Hospitals, Research and Experimental Laboratories—a veritable Roll Call.

Last month we extended our explanation and apology for the inevitable results on non-defense orders. Now relief seems ahead. Despite many difficulties and unexpected delays our new building is nearly completed and will soon give us increased facilities.

OUR PROMISE:

To the extent mandatory priorities, restricted materials, and limits of human endurance allow, we pledge ourselves to render the very best service our experience, skill and resources will permit.

Meanwhile, may we again ask your patience and forbearance.

MARLO
COIL COMPANY
6135 Manchester Ave., St. Louis, Mo.
Manufacturers of
HEAT TRANSFER EQUIPMENT

to the diaphragm of a pump governor for protection of the pressure gage mechanism and tube, also the spring, diaphragm and stem packing. It is also effective as protection to a control valve, such as a back pressure or reducing regulator and for use with sensitive control instruments subjected to pulsating flow, according to the maker, who states that the valve will handle steam, fuel oil, gas, water or other liquids, with a simple adjustment for each viscosity.

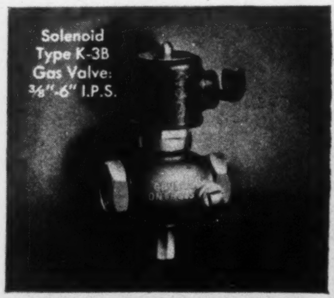
The device consists of a solid brass body in which a filter is inserted for protection from foreign matter. The valve has an extremely slight taper so that very sensitive control of the shut-off is effected. This slight taper minimizes the tendency to pinch off, under changing pressure conditions, to approximately 2 per cent of what is usual ordinarily, according to the inventor. The micrometric control of the opening enables the operator to obtain close approach to full shut-off.—J. A. Campbell Co., 645 E. Wardlow Rd., Long Beach, Calif.

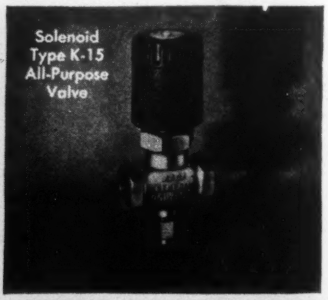
Time Switch

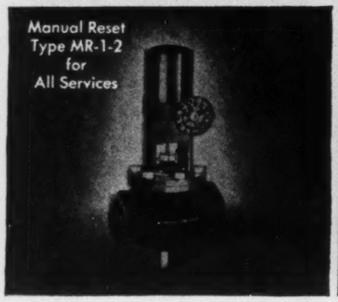
No. 2146—The new "300" series time switch has just two exposed gears, all others operating in a sealed oil bath and consequently always lubricated. It is not affected by dust, the maker states. Operation is accomplished by a slow speed (450 rpm) industrial type, self-starting synchronous motor.

The case is compact, and is made of 18 ga steel with a seamless drawn cover and base, streamlined and modern throughout.—Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.

GENERAL CONTROLS
SOLENOID AND MOTOR VALVES
SUITABLE FOR EVERY GAS, LIQUID AND VAPOR







Motor
Operated
Type G-2 for
All Services

For a dependable source of supply of quiet, trouble-free, two-wire automatic industrial valves for all services, General Controls has a better control to meet your requirements. Nationwide sales and service. Write for complete Catalog.

GENERAL CONTROLS
801 Allen Avenue, Glendale, California
New York City · Boston · Philadelphia · Cleveland · Detroit
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Useful Information

American Standards

The American Standards Association, 29 W. 39th St., New York, N. Y., has recently issued a 16 p. booklet indexing American standards according to the fields to which they pertain, and also by the products they cover. This index is available on request to the ASA.

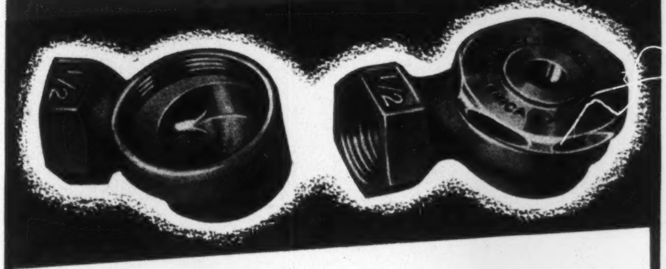
Some 400 American standards have been approved to date in a wide variety of industrial fields and in the field of industrial and public safety.

The Hydraulic Ram

Bulletin No. 326 of the Engineering Experiment Station, University of Illinois, Urbana, is entitled An Analytical and Experimental Study of the Hydraulic Ram. It was prepared by Wallace M. Lansford, assistant professor of theoretical and applied mechanics, and Warren G. Dugan, research graduate assistant in theoretical and applied mechanics. Comprising seventy 6x9 in. pp., copies may be obtained without charge upon application to the Engineering Experiment Station, until November 15, or until the supply available for free distribution is exhausted.

The hydraulic ram is a device which uses the kinetic energy in a moving column of water to lift part of that water to a height greater than that of the source of supply. Despite the widespread use of the ram, the anal-

THE PERFECT NOZZLE FOR AIR CONDITIONING ...ROTOJET by BINKS



Rotojet breaks up the fluid into an ultra fine uniform spray. Specially designed for air conditioning, refrigeration and similar uses. Comes in a wide variety of sizes and capacities. Precision made of tough marine bronze. Also available in special alloys and stainless steel. **WRITE FOR BULLETIN 250,** which describes this and other BINKS spray nozzles.

BINKS MANUFACTURING COMPANY
3114 CARROLL AVENUE Dept. H440 CHICAGO, ILLINOIS

PETRO
Reg. U. S. Pat. Off.

is making IMMEDIATE DELIVERIES to HEATING CONTRACTORS on

INDUSTRIAL OIL BURNING SYSTEMS

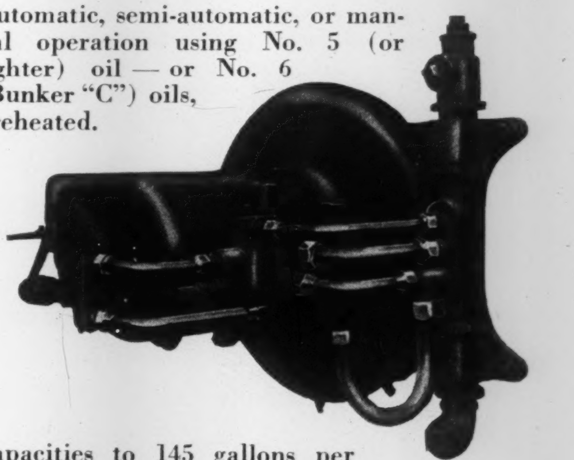
—despite the fact that a large part of Petro's current production of Industrial burners is going into such defense construction as Powder Mills, Armament Factories, Machine Tool Makers, and many of the secondary or intermediate lines of production.

Known performance and dependability are probably primary reasons for these selections of Petro, but the immediate availability of the equipment and engineering service are also vital factors.

In addition to quick shipment, Petro gives Heating Contractors these advantages:

1. A range of equipment wide enough to match the needs of any boiler plant with any grade of fuel oil;
2. Manufacturing and servicing experience from nearly forty years of specializing on one line;
3. Operating efficiency and economy proofs from thousands of installations in use for years;
4. Unusually complete engineering co-operation; this definitely includes the plant engineer after the contractor turns the system over;
5. Security to the contractor's reputation and profit, which results from these basic factors when a contractor installs a Petro system.

Automatic, semi-automatic, or manual operation using No. 5 (or lighter) oil — or No. 6 (Bunker "C") oils, preheated.



Capacities to 145 gallons per hour. 487 boiler H. P. — 68,000 sq. ft. steam.

Petro Model W-AH burner illustrated above provides automatic operation on pre-heated No. 6 (Bunker "C") fuel oil; a self-contained assembly of motor, fan, pump, rotary cup atomizer and interlocked air and oil adjustments.

The Petro Thermal Viscosity Principle eliminates all need for frequent manual mechanical adjustments of oil temperature or rate of flow, even on "cold starts" or during wide fluctuations of steam demand or draft conditions.

FOR FURTHER INFORMATION SEE OUR CATALOG IN SWEET'S

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

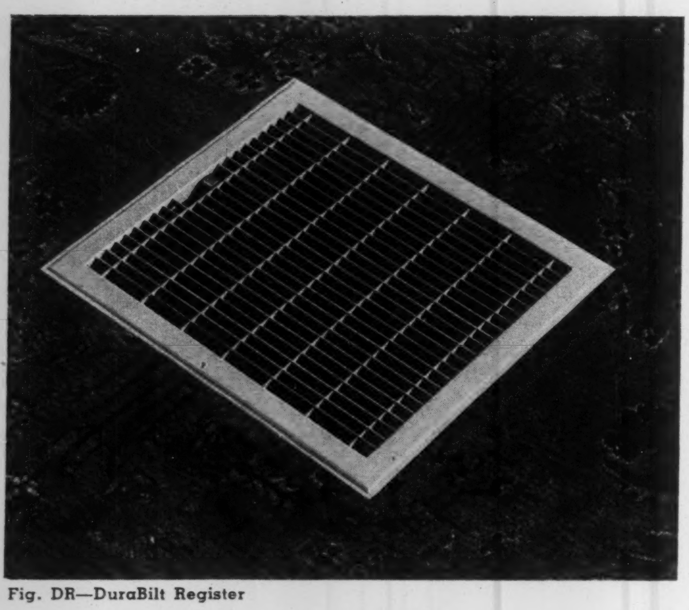


Fig. DR—DuraBilt Register

DURABILT

Floor Registers and Cold Air Faces

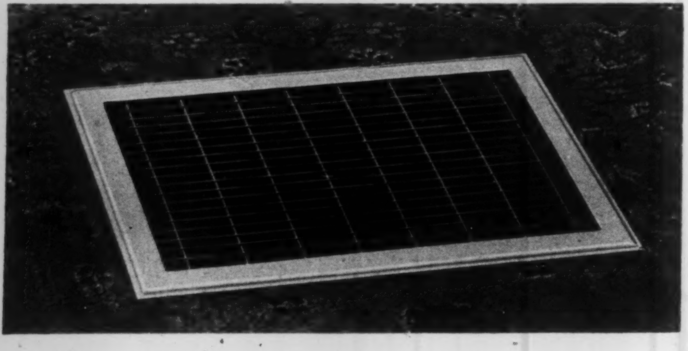
Now furnished in narrow mesh (1/2" by 2" on centers) as standard, Auer DuraBilt Floor Registers and Intakes offer a still finer product, both in appearance and service. The 7/16 by 1-15/16 opening is heel-proof, excludes small objects such as chair legs, and tends to conceal the register box interior. These registers and intakes are assembled with flat steel bars, mortised and interlocked at every cross-joint. This assembly is tenoned and locked into welded frame, making a rigid and durable construction. Open area is 81%. A better register—and, at no advance in price, a better value.

Write for complete Auer Register Book 41, showing all models for air conditioning and warm air systems. Special Grille Catalog "G" also sent on request.

AUER Registers and Grilles

The Auer Register Co.
3608 Payne Ave.
Cleveland, O.

Fig. DSC—DuraBilt Cold Air Face



ysis of its actual operating characteristics is not generally known, though empirical performance guarantees are, of course, made by manufacturers.

The object of the investigation described in this bulletin was to make a rational mathematical analysis of the operation of single acting automatic hydraulic rams, and to compare the results of such an analysis with those found from an experimental investigation of the rams. Many variables are involved in the operation of the ram, but those of primary interest to the designing or operating engineer are the rate of pumping and the rate of wasting (the weight of water pumped or wasted per unit of time). The objective of the analysis was to determine the rate of pumping and of wasting for any condition of operation.

As a result of the investigation it was found that the quantity pumped per cycle, and the quantity wasted per cycle, can be predicted with an error of less than 10 per cent for delivery pressures less than one-half the maximum pressure the ram is capable of developing for a particular setting of the waste valve; for higher delivery pressures the error in prediction is somewhat greater, but at these higher delivery pressures the quantity pumped is so small that in general the use of the ram under such conditions is not practical.

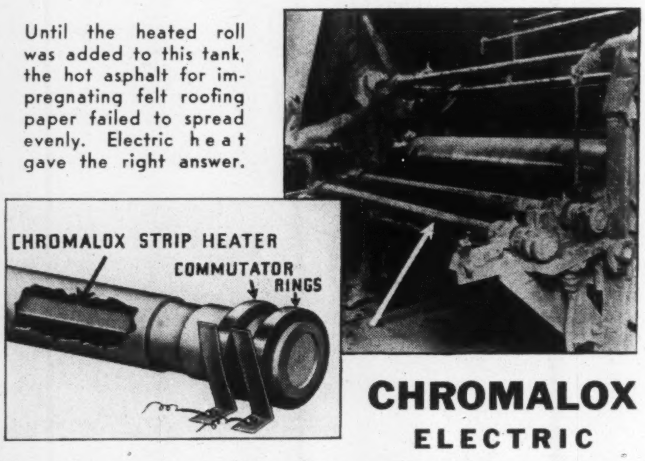
Clinical and Physiologic Investigation of Air Conditioning

In a paper entitled Clinical and Physiologic Investigation of Air Conditioning, presented by Dr. M. B. Ferderber before the Medical Society of the State of Pennsylvania—and published in the Pennsylvania Medical

HEATED ELECTRICALLY,

this roll improves asphalt-coated product

Until the heated roll was added to this tank, the hot asphalt for impregnating felt roofing paper failed to spread evenly. Electric heat gave the right answer.



The picture above shows how Chromalox strip heaters clamped to the inside of the roll, are supplied with electric power through commutator rings. Four 900-watt strip heaters provide the necessary 350 deg. F. needed to properly heat the roll. This type of application is used in a variety of equipment having heated revolving members.

CHROMALOX ELECTRIC HEATING UNITS

can almost invariably be selected from stock to meet any condition involving industrial heat. Units for heating liquids, machine parts, process, air blast, ovens, etc., up to 1000 deg. F. Engineering cooperation offered. Chromalox Book of Electric Heat sent upon request.

EDWIN L. WIEGAND COMPANY
7610 Thomas Blvd. Pittsburgh, Pa.

Journal for December, 1940—the author described results of a number of air conditioning studies of interest to the medical profession, and summarized the results of this work as follows:

1) Air conditioning based on the effective temperature scale causes both physiologic changes and definite feelings of comfort in humans. In operating and recovery rooms controlled environments are beneficial to operating room personnel and to patients in preventing excessive fatigue and drop in body temperature in the latter. Air conditioning has reduced the bacterial content of an operating room, but sterility of the air has not been obtained by these means.

2) A relative humidity of 65 per cent and a dry bulb temperature of from 77 to 100 F in nurseries have reduced the physiologic weight loss of prematures in the first four days of life from 12.4 per cent of the birth weight in an ordinary nursery to 6 per cent in a conditioned nursery. The number of days required to regain the birth weight is less in a nursery where the environment is controlled, and the survival rate, therefore, is much higher.

3) Production of fever in either a part or the whole body is facilitated in a saturated atmosphere to give safer but more prolonged treatment periods.

4) The exposure of persons to high temperatures for other than therapeutic purposes produces an elevation of body temperature, an increase in pulse rate, and a white blood cell increase in effective temperatures from 84 to 92 F.

5) A dry bulb temperature of 65 F and 50 per cent relative humidity are the optimum conditions for an oxy-

CALK all Joints
WITH PECORA COMPOUND
FOR EFFECTIVE
AIR CONDITIONING
AND HEAT CONSERVATION

TEMPERATURE control is the vital factor in both air conditioning and heat conservation (fuel saving). Such control is materially aided when calking is provided around all window and door frames and when all building joints and air ducts are sealed.

The preferred calking material is PECORA. It has been used by reliable contractors since 1908. A majority of the largest and most important buildings in recent years have been calked with PECORA.

Pecora Calking Compound is impervious to heat, cold and moisture. Properly applied, it will not dry out, crack or chip. It is made of finest ingredients, to special formula, and is unvarying in quality and performance.

Write for Folder and Prices

PECORA PAINT COMPANY, Inc.
Established 1862 by Smith Bowen
Fourth St. & Penna. R. R. Philadelphia, Pa.
Member of Producers' Council, Inc.

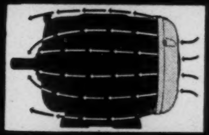
100% GLASS INSULATION
Streamcooled DESIGN

BALDOR GIVES YOU *TODAY*
THE MOTOR OF TOMORROW

STREAMCOOLED DESIGN provides a totally-enclosed ball-bearing motor with an unfailing, NON-CLOGGING cooling system.

GLASS-INSULATED motors withstand higher temperatures SAFELY and provide more HP. in smaller frame sizes.

These and many other features at NO EXTRA COST to you.



Streamcooling
Illustrating forced air movement over entire exterior of motor frame.

BALDOR ELECTRIC COMPANY, ST. LOUIS
Representatives in Principal Cities

BALDOR
BETTER MOTORS

The closer you look
The better you'll like it:

DIRECTHERM
HEATER

the direct-fired Unit Heater in 6 sizes (300,000 - 1,700,000 BTU) for plant, office, and shop.

It is a real fuel saver. Whether you burn oil, gas, or coal—it produces about 80% of the invested fuel energy and distributes it evenly up to 200 feet distance. That's heating efficiency!

The Directherm Heater is built to keep your cost down. The first cost is low, the installation simple, and the up-keep negligible, due to the sturdy construction.

Start your saving program today by writing for our bulletin 305 Z. It tells you the whole story.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

gen tent where the oxygen concentration is 50 per cent or more.

6) The allergic patient requires 75 F dry bulb temperature and a relative humidity of 50 per cent or lower in addition to an efficient air cleaner which will remove offending particles of 15 to 20 microns or smaller.

Effective Temperature Scale

Dr. Murray B. Ferderber, of the school of medicine of the University of Pittsburgh, and F. C. Houghten, director of the ASHVE research laboratory, presented a paper on the effective temperature scale at the 91st annual session of the American Medical Association in New York last June. The paper, 10 pages in length, was published in the Journal of the AMA for February 8, 1941.

The paper represents a quite complete discussion of effective temperature and the factors affecting human comfort.

Book Reviews

Lessons in Arc Welding

[Lessons in Arc Welding. 2nd ed. 1941. 176 + v pp., 5¾ x 8½ in., semi-flexible simulated leather binding. Published by Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. Price, 50c in U. S. A., 75c elsewhere.]

This book makes available to industry and to engineering colleges and universities, and to trade and vocational schools, the accumulated welding instruction information from the Lincoln welding school, which has been in continuous operation for 24 years. It comprises a series of 60 lessons which present in concise manner the fundamental facts of welding, knowledge of which will enable the welder to utilize the process successfully and economically.

Text explanations are supplemented by line drawings and photographs, and a valuable feature of the book is the set of questions and answers for each lesson to enable the student to check his knowledge. The lessons are carefully indexed for convenient reference.

Accounting for Engineers

[Accounting for Engineers, by John R. Bangs, Jr., professor and head of the department of administrative engineering, Cornell University, and George R. Hanselman, associate professor of administrative engineering, Cornell University. 1st ed. 1941. 532 + xi pp., 6 x 9 in., flexible binding. Published by International Textbook Co., Scranton, Pa. Price, $4.00.]

Because engineering is an important pathway to executive responsibility, and because the engineer in assisting the direction of an enterprise must have the ability to read and interpret the accounts of that enterprise, he should have a knowledge of accounting. This book has been written to give him that knowledge, and while primarily designed for use as a text in college courses, it is well adapted to home study also.

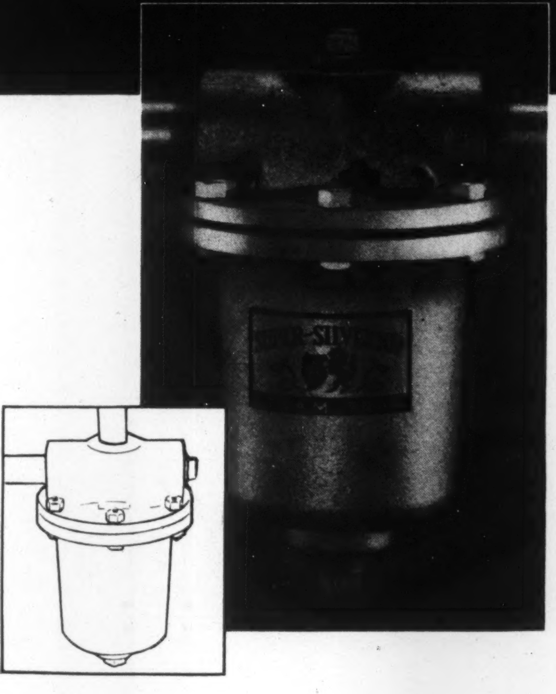
Numerous charts and graphs are used to describe accounting principles "because students in engineering and business administration are trained to visualize and to learn more quickly and easily through graphical presentation." The material covered includes the theory of

ONLY
ANDERSON
Super-Silvertop
STEAM TRAP
has—

STRAIGHT-IN-LINE
CONNECTION
plus
ELBOW CONNECTION
plus
GUIDED INVERTED BUCKET
and
NO CORED PASSAGES

WRITE FOR COMPLETE DETAILS

THE V. D. ANDERSON COMPANY
1949 WEST 96TH STREET • CLEVELAND, OHIO



Humidity Control & Air Conditioner USING PATENTED CHEMICAL

■ LOW FIRST COST
■ LOW OPERATING COST

Calorider
TRADE MARK REG. U. S. PAT. OFF.

At last, Humidity Control and Air Conditioning at a very low first cost and an exceptionally low operating expense.

The CALORIDER is a scientifically designed Unit to DEHUMIDIFY AIR—to FILTER and COOL AIR—and to HUMIDIFY AIR in Winter. Encased in an all metal cabinet, the CALORIDER delivers up to 1500 cu. ft. of air per minute; also small portable Units—100 to 250 cu. ft. of air per minute.

The CALORIDER is charged with a patented, moisture absorbing chemical, "Caloride." Air drawn through the Unit comes into contact with this chemical which removes MOISTURE, DUST, ODORS and POLLEN.

The CALORIDER will solve, at a reasonable cost, many commercial problems where humidity control is essential, either in manufacturing or storage.

Write Dept. HP Today, for information and engineering data on CALORIDERS.

The General Air Conditioning Corporation
Appleton Street—Cincinnati, Ohio

Has double shaking twin grates. Capacity up to 14,600 sq. ft. net load for steam, 23,360 sq. ft. net load for water.

Hank sez—

As how the shortage in steel makes this Twin Section Cast Iron Boiler a godsend

If the government is all het up and bothered about there not being too plenty of steel ter go around, then steel boilers is going ter have an uphill job gettin' made.

There's maybe agoing ter be a lot of waiting fur deliveries. when waiting is jist plumb out.

Altho we make steel boilers aplenty, we ain't so blind we can't see hand writin' when it's stuck in our face.

Some folks—maybe you are one of 'em—has took ter using our big cast iron Twin section boiler. They know it needs no tackle contrapshun to set it up. And as how its sections and base can be slid handy-like thru any man-sized doorway, and no tearing out needed.

All of which is facts, it might be smart fur you engineerin' fellers ter remember not ter fergit.

Hank

Burnham Boiler Corporation
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Burnham Boiler

debit and credit, procedure at the end of the fiscal period, accounting practice, accounting applications, and costs. An appendix presents the financial statements of several corporations.

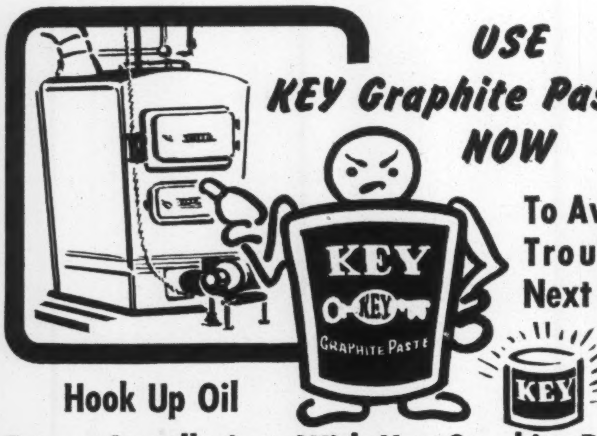
Temperature Measurement

[Temperature Measurement, by Robert L. Weber, school of chemistry and physics, Pennsylvania State College. 1st ed. 1941. 171 pp., 8⅜ x 11 in., planographed, paper binding. Published by Edwards Brothers, Inc., Ann Arbor, Mich. Price, $2.50. Orders should be addressed to the W. B. Keeler Bookstore, Cathaum Bldg., State College, Pa.]

This book is a technical treatment of the subject of temperature measurement, discussing the many advances which have been made in this field in recent years and including illustrations and references to the original papers. It is quite comprehensive, its purpose being to outline an experimental study of the methods of temperature measurement with the theoretical principles necessary for their appreciation, intelligent use and extension.

The theoretical basis of temperature measurement is presented in Part 1, and Part 2 is devoted to laboratory experiments. Part 3 comprises the appendix, which presents useful data in tabular form and also includes perforated question sheets, coördinate paper and a cross-index.

The book presents the substance of the course offered for juniors by the physics department of the Pennsylvania State College, one year of elementary physics being the prerequisite.



USE KEY Graphite Paste NOW

To Avoid Trouble Next Fall

Hook Up Oil Burner Installations With Key Graphite Paste

That's the one sure way to avoid "come-back" calls to repair leaky oil lines.

Start using Key Graphite Paste NOW on all thread and gasket connections on lines to carry hot or cold oil and oily liquids. You'll find Key Graphite Paste is economical, because "A Little Goes A Long Way." Carry it with you at all times . . . it will save you money and time, and will build "good will" because it does the job *right* the first time.

P. S. For High-Pressure Steam, Too—Key Graphite Paste is the ideal sealer—try it.

Liberal Free Sample. Write for a free sample of Key Graphite Paste today. Test it out on your next job and you, too, will become a Key Paste enthusiast like thousands of others.

KEY COMPANY

2617 McCasland Ave. East St. Louis, Illinois

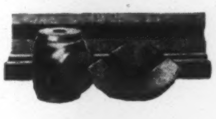
Welded Steel Tubing Handbook

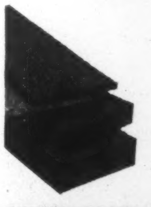
[Handbook of Welded Steel Tubing. Revised January, 1941. 86 pp., 4¾x8¼ in., looseleaf binding. Published by Formed Steel Tube Institute, 1621 Euclid Ave., Cleveland, Ohio. Price, $1.00.]

Improvements and refinements which have been made in the processes employed for manufacturing welded carbon and alloy steel tubing during the past 10 years have resulted in the adoption of this material for structural uses in many industries. There are inherent advantages in welded tubing due to the fact that it is formed from flat rolled strip and has high physical properties and true concentricity of section.

This handbook has been published to furnish designing engineers with full information regarding standard sizes and properties of welded tubing. It is devoted exclusively to those grades of welded tubing which can be figured as having a solid wall structure with no discontinuity or variation in physical properties occurring in the area affected by the welding operation during manufacture. Standard sizes, together with commercial tolerances for roundness, wall thickness, straightness, etc., are tabulated for various grades of welded tubes. The manufacturing and fabricating processes are illustrated, and typical examples show to what degree welded tubing can be cold worked in such operations as bending, beading, flanging, expanding, tapering, etc. Special attention is given to recommendations for laying out fabricated parts and methods of checking.

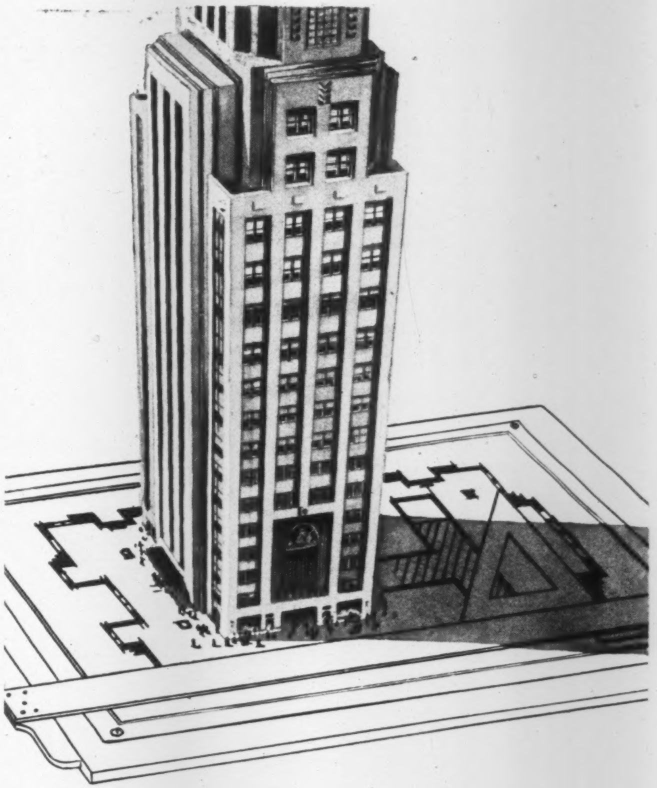
SAVE
AIR CONDITIONING DOLLARS
WITH *Novoid*





YOU can cut air conditioning losses to a minimum by guarding cold air ducts and piping with **NOVOID CORKBOARD** and **CORK COVERING.** This pure **CORK** insulation bars the passage of heat, prevents condensation, and keeps its money-saving efficiency for years. For details and name of nearest Novoid Distributor, write Cork Import Corp., 330 W. 42nd St., New York City.

NOVOID CORK INSULATION



A building comes to life when it's heated

THE beauty—the strength—the rhythm of lines in the vision of the architect create a monument to his skill. But when does that monument become a habitation?

A building lives when heat tempers it to the uses for which it was conceived—for work, rest or recreation. Since heating, therefore, makes serviceable the creation of the architect, heating becomes with him, his consulting engineer and his client a first consideration.

Buildings of every type, from coast to coast, prove that Dunham Heating increases the comfort and efficiency of humankind, decreases the operating and maintenance costs of heating. An unusually graphic brochure on heating with "Sub-atmospheric" Steam is available. Write for brochure No. 614.

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has made
HEATING
SERVE YOU
BETTER
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"Dunham Heating Service" is available through the telephone in more than 60 cities, or by correspondence to C. A. Dunham Co., 450 E. Ohio St., Chicago.

SUB-ATMOSPHERIC STEAM SYSTEMS DUNHAM LOW PRESSURE STEAM APPLIANCES VACUUM AND CONDENSATION PUMPS UNIT HEATERS CABINET **DUNHAM** HEATING SERVICE AND CONCEALED CONVECTORS PACKLESS RADIATOR VALVES THERMOSTATIC RADIATOR TRAPS FLOAT AND THERMOSTATIC TRAPS DRIP TRAPS RETURN TRAPS

HOW DO YOU SPECIFY INSULATION FOR AIR-CONDITIONING DUCTS?

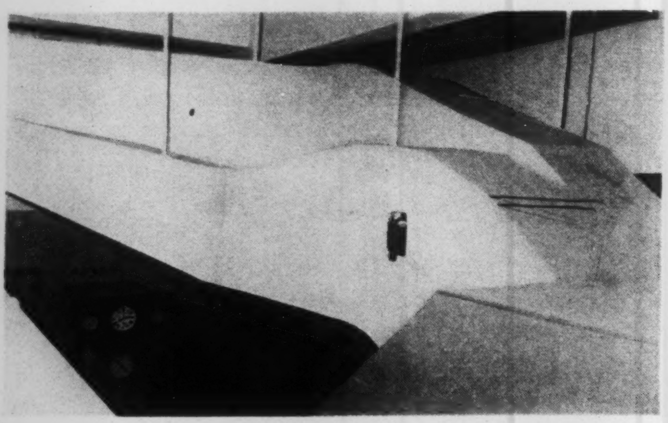
On Efficiency?

If you want *permanent* efficiency, use J-M Rock Cork. This basically mineral material offers unusual resistance to moisture. It will not rot or decay. The proof of its long life and low maintenance is shown in scores of installations that show no signs of deterioration after years of service.

On Cost?

If you want *low* cost, use J-M Rock Cork. You pay no more for this lasting material than for less effective insulations. It is completely uniform, for it is factory-made to an exact formula under rigid laboratory control. And installed costs are low, for Rock Cork is easy to work and handle . . . quickly applied.

For full details, write for brochure DS-555. Johns-Manville, 22 E. 40th St., New York, N.Y.



S. H. KRESS & CO. STORE, San Antonio, Texas. Both concealed and exposed ducts insulated with 1" Rock Cork Sheets. Concealed ducts are finished with ½" J-M Asbestos Cement and canvas jacket. Plenums are insulated with 2" Rock Cork Sheets, finished as above. Also used are 1" double-layer J-M Anti-Sweat on chill-water piping; standard thick J-M 85% Magnesia on steam-supply and return piping; ¾" J-M Wool Felt on hot-water system.

JM

Johns-Manville ROCK CORK

Sheets and pipe covering

Anthracite Conference

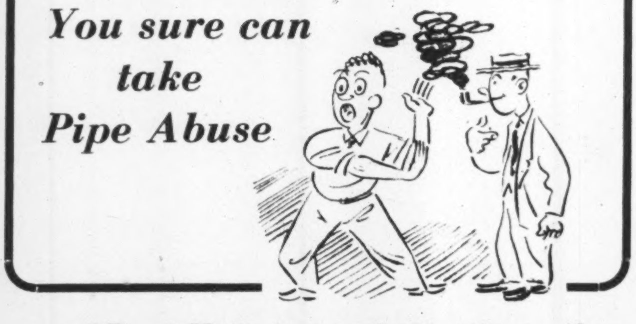
[Transactions of the Fourth Annual Anthracite Conference. 237 pp., 6 x 9 in., paper bound. Published by Anthracite Industries, Inc., Chrysler Bldg., New York, N. Y. Price, $1.50.]

This book includes the various papers which were presented at the fourth annual anthracite conference at Lehigh University, Bethlehem, Pa., May 8-9, 1941.

The papers included are: importance of mineral industries to the commonwealth of Pennsylvania, by W. M. Myers; heating for Pennsylvania turnpike buildings, by Edgar O. Marty; experience in using anthracite coal in the manufacture of basic carbonate white lead, by E. D. Turnbull; practical pointers in domestic stoker installations, by Joseph K. Goundie; practical merchandising of anthracite from the dealer viewpoint, by Carl A. Fraser; needed trends in boiler and furnace design, by M. A. Young; observations on the use of anthracite in foundry cupolas, by J. F. K. Brown and Earl E. Roecker; market opportunities for anthracite, by J. D. Jillson; future research in the anthracite industry, by Frank C. Wright, Jr.; anthracite fuel beds in water gas generators, by C. C. Wright and L. L. Newman; anthracite research at Mellon Institute, by H. J. Rose; the use of anthracite for burning brick, by H. L. Campbell, Jr.; advanced developments in the control of the combustion of anthracite, by Allen J. Johnson; preparation of activated carbon from Pennsylvania anthracite, by Eric Sinkinson; performance of anthracite fired water heaters, by R. C. Johnson; and factors affecting thermal comfort, by C. P. Yaglou.

WOW!

You sure can take Pipe Abuse



...and Dart Unions can take abuse, too

It's because Dart Unions have matched bronze seats, ground to accurate "true-ball" surfaces that they can make up tight so quickly, stay tight so much longer and can be re-installed so many times. And it's because the nuts and bodies of Dart Unions are made of air refined malleable iron that this equipment can put up such strong resistance to pipe strains, abuse and corrosion.

Try Darts for yourself—you get *more* for your money.

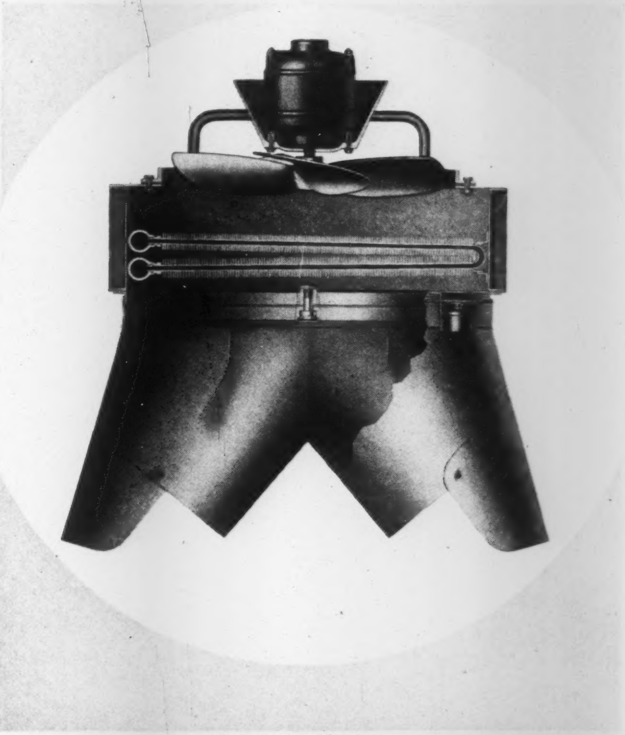
DART UNIONS

E. M. DART MFG. CO., PROVIDENCE, R. I.

SALES AGENTS: THE FAIRBANKS COMPANY, NEW YORK AND ALL BRANCHES — CANADIAN FACTORY: DART UNION COMPANY LTD., TORONTO, CANADA

duction Problems
WINGS

UNIT HEATERS



IN this patented construction, uniform distribution of heat is accomplished because the moving streams of heated air sweep slowly around through 360 degrees . . . the constantly changing direction of flow causes the heated air to find its way around obstructions . . . the air velocity is sufficient to carry the heat to walls and remote corners . . . thus keeping every part of the plant at an even, comfortable temperature.

The gentle air motion created by the constantly changing direction of a WING Revolving Unit Heater brings a sensation of fresh, live, invigorating warmth to workmen, increasing their sense of comfort and promoting health and efficiency

Obviously, with WING Revolving Unit Heaters distributing the heated air so evenly, no concentration of heat is possible in one spot and no objectionable blast is felt as from unit heaters with fixed discharge outlets.

Not only manufacturing plants have been benefited by WING Revolving Unit Heaters, but also buildings with unique heating problems, such as repair garages and airplane hangars, where, for example, buses or planes obstruct the projection of heat to the floor and where quick warming of interiors is necessary due to the frequent opening of large doors. WING Revolving Unit Heaters have also completely satisfied the requirements of warehouses, where even temperatures are essential to prevent spoilage of perishable commodities.

Send for Bulletin HR-1 for full details.

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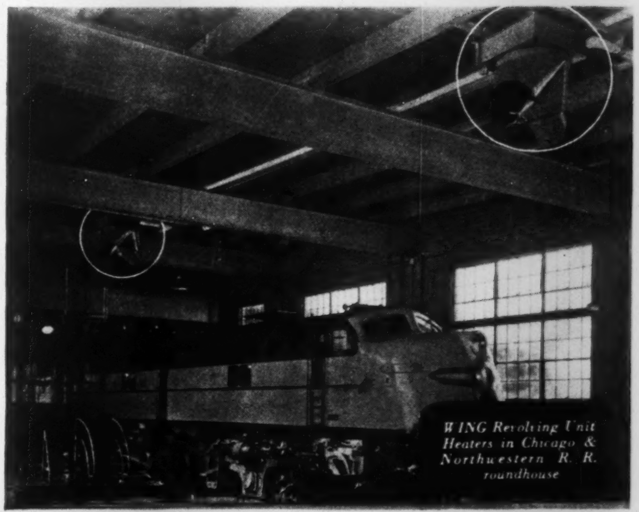
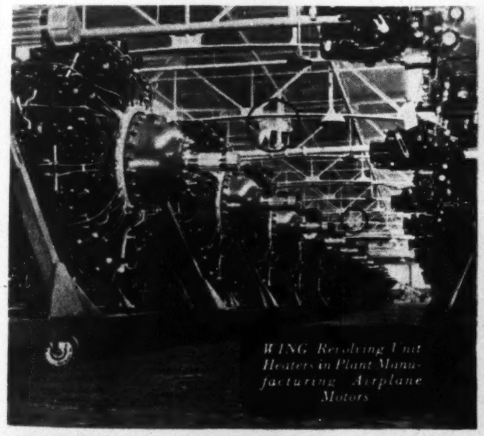


WING Revolving Unit Heaters in Chicago & Northwestern R. R. roundhouse



WING Revolving Unit Heaters in Plant Manufacturing Airplane Motors

NORTH COAST LINES

WING Revolving Unit Heaters in North Coast Transportation Co. Bus Garage, Seattle, Wash.

Wing Revolving Unit Heaters in plant of Hepworth Co., L. I. City, New York

N G

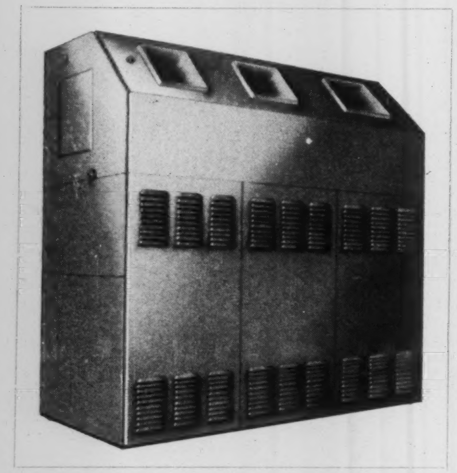
BLOWERS·TURBINES
EXHAUSTERS · FANS

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

15 Ton Self Contained Unit

No. 2147—The new large capacity 15 ton self-contained air conditioner illustrated is a complete air conditioning system in itself, according to its manufacturer. It may be arranged in a regular central system incorporating an evaporative condenser. Only the simplest of duct work arrangements are necessary.

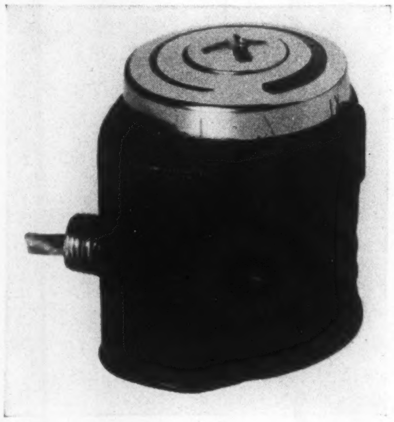


The unit includes three 12 in. DWDI fans, a reciprocating compressor, a direct expansion cooling coil, a spray type humidifier and has provision for the inclusion of a heating coil if such is desirable.

The discharge connection is designed at a 45 deg angle, permitting duct connections to be made directly with 45 deg angles in the supply duct for either horizontal or vertical travel. Individual 45 deg duct turns are provided should they be required on the job and these nozzles are complete with proper duct turns to permit efficiency in the air delivery.—Trane Co., La Crosse, Wis.

Radiator Venting Valve

No. 2148—A new radiator valve ("Dialon") with a numbered dial and vent setting attachment, has been introduced. Its chief feature, says the maker, is its micrometer accuracy of adjustment and controlled uniform rate of venting which takes place at each setting of the dial. The dial shows 10 different venting speeds and a crescent shaped slot on its top shows at a glance the extent of adjustment made. Each number on the dial represents a change in venting rate 60 per cent higher or lower than the next number. The valve's drainage arrangement makes it drip proof, it is stated.



Short in height, the valve fits the new thin radiators and eliminates the necessity of moving the radiator away from the wall.—W. A. Russell & Co., Bridgeport, Conn.

Industrial Multibreaker

No. 2149—A new 230 volt industrial multibreaker affords exceptionally economical application as a motor circuit switch or service disconnect switch, says the manufacturer. It is fuseless, with bimetallic strip actuation, visible trip indication, and trip free lever. It is quick make and quick break, with a rated capacity of 230 volts from 15 to 100 amperes, available in three pole, three pole solid neutral or four pole solid neutral types.

CUTLER-HAMMER

Calibration is set at the factory and cannot be tampered with. The breaker is completely enclosed and semi-dust tight.—Cutler-Hammer, Inc., N. 12th St. and W. St. Paul Ave., Milwaukee, Wis.

Time Cycle Controller

No. 2150—A new multiple cam time cycle controller (known as the "Model A-118 Impulse Sequence Cycle Controller") for timing mechanical operations in industrial processes is designed for use on tire molds and

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [8-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2147 2148 2149 2150 2151 2152 2153 2154
3933 3934 3935 3936 3937 3938 3939 3940 3941 3942
3943 3944 3945 3946 3947 3948 3949 3950 3951 3952
3953 3954 3955 3956 3957 3958 3959 3960 3961 3962
3963 3964 3965

Name .... Title ....
Company ....
Address ....
City .... State ....

LOCKER PLANT AGE
ICE COLD 2¢
HELEN
A.J. BR
TOM ♡ MARY

"Gee! This ad says your capital investment is lower with systems using FREON*"

THAT'S RIGHT, JUNIOR! Locker plants can save plenty with the direct expansion system using "Freon" refrigerants. Their capital investment is lower because they don't have to buy brine coolers, pipes and pumps. They save on operating costs, too. By cutting out the extra step of cooling brine, found where a secondary system is used, horsepower requirements are lowered, often saving as much as 25% in power costs.

The direct expansion system using "Freon" refrigerants gives your customers the fastest economical freezing known. This system uses plates instead of brine coils. Plates permit faster sharp-freezing, because food resting on pipes gets only a fraction of the cooling contact obtained by food in direct contact with the plate. This permits the use of a smaller sharp-freezing room, allowing more locker space to produce income.

In meat curing, quick freezing and holding rooms, the plate system permits uniform temperatures at the desired level. This avoids the need for excessive low temperatures where the cooling surface is inadequate . . . eliminating the formation of heavy deposits of frost, dehumidification of air, and the dehydration of meat and other foodstuffs.

Your customers can literally sweep frost away when they use the direct expansion system. Frost on plates is easily removed with a broom. This saves time in defrosting, and it ends the losses in efficiency caused by heavy frosting of pipes.

And remember, "Freon" refrigerants are completely harmless to food. No danger of heavy losses which might result from refrigerant leaks, causing spoiled meats, vegetables, fruits or berries.

These are some of the reasons so many locker owners insist on compressors using "Freon" refrigerants. The more you investigate, the more you'll be convinced there's only one choice for locker plant use—"Freon" refrigerants.

4 *big advantages*

"Freon" brings to locker plants

▼ ▼ ▼

1. *Lower Capital Investment*
2. *Lower Power Cost*
3. *Easier Defrosting*
4. *Less Shrinkage*

KINETIC

FREON

REG. U. S. PAT. OFF.

safe refrigerants

"Freon" is Kinetic's registered trade mark for its fluorine refrigerants

KINETIC CHEMICALS, INC., TENTH & MARKET STREETS, WILMINGTON, DELAWARE

Asbestos Protected

DUX-SULATION

for SOUND ABSORBING AND INSULATING, HEATING, VENTILATING AND AIR CONDITIONING DUCTS

Meets New Needs!

If you, too, are using black iron sheets for duct work, it is all the more important that the ducts be protected with Dux-Sulation to prevent them from rusting. To apply Dux-Sulation the entire duct is coated with a Rubber Base Cement which serves not only as the adhesive for holding the insulating felt in place but as a protective coat for the metal as well.

Has These Superior Features

Dux-Sulation has a 75% insulating efficiency (K factor .27 B.T.U.) . . . High Sound Absorbing efficiency (70%) . . . Low Frictional Resistance . . . Prevents Condensation . . . Will not rot, chip or flake . . . Easiest Insulation to apply and looks best . . . Comes Complete, nothing else to buy . . . Is easy to handle in stock or on the job . . . Each roll contains 100 sq. ft. of standard ½" thickness.

When you have insulated your ducts (either galvanized or black iron) with Dux-Sulation you get the utmost in operating efficiency at a minimum cost. "It pays for itself."

Write office nearest you for details

GRANT WILSON, INC.
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PLANT RUBBER & ASBESTOS WORKS
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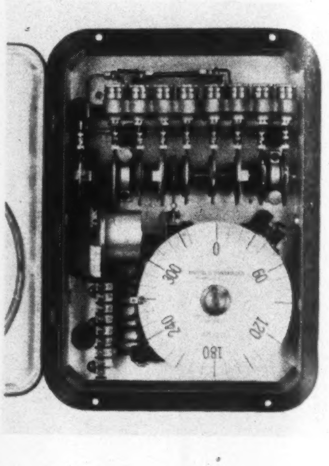
AIR CONDITIONING UTILITIES CO.
8 West 40th Street NEW YORK

ATLAS ASBESTOS CO., LTD.
110 McGill St. MONTREAL, CANADA



other plant processes where a number of factors must be accurately timed according to a fixed program. In operation the controller actuates or engages, at exactly the correct time in each cycle, the necessary mechanical, electrical or pneumatic devices for automatically carrying out the intended schedule.

Time measurement and pilot valve operation are handled by separate mechanisms. Separation of these two basic functions made possible a design that gives accurate timing of the factors under control, high speed and torque for pilot valve operation, and flexibility of application, according to the manufacturer.

Timing is accomplished by a telechron driven aluminum disc on which is printed a 25 in. time scale. The desired schedule of operations is incorporated into the controller by punching holes with an ordinary ticket punch on the time scale. The location of these holes determines the time of operation of the cam mechanism. Discs for new cycles or schedules of operation can be easily made.

The cams are individually adjustable and their setting does not require fine adjustment. Any sequence of operation can be obtained.

All controllers are drilled for eight cams and pilot valves. Additional cams and pilot valves up to a total of eight can be added by the user to controllers originally made up with less than eight cams.—The Bristol Co., Waterbury, Conn.

Rubber Gasket for Piping

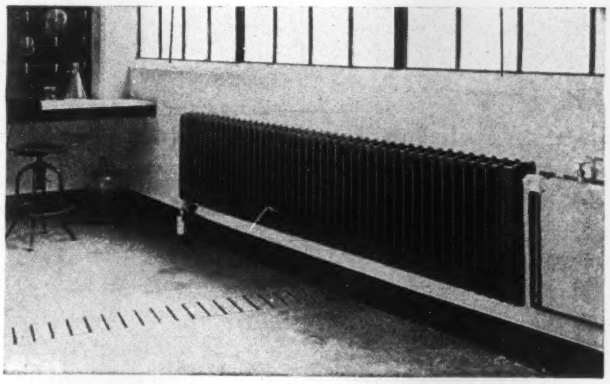
No. 2151**—A new patented rubber gasket is designed so that pipe couplings can be assembled simply and easily in the field and at the same time provide a seal that is not disturbed by any new conditions on the pipe, states the manufacturer. The gasket, like a rubber band, is laid over the lip end of the pipe. It is provided with a number of circumferential ribs which fold into place when the next section of the pipe is forced over them, locking the two lengths together. These ribs resist pressure thrusts and soil stresses.

This gasket is manufactured for sizes ranging from ¾ to 108 in. pipe, and can be applied to pipe of any composition, including iron, copper, brass and concrete.

The gasket is designed for either light duty or pressure couplings. The light duty couplings find their principal uses in irrigation piping, sanitary lines, sewer lines and low pressure water lines, while the high pressure couplings are installed in municipal and industrial water systems, oil gathering or transmission pipe lines and for miscellaneous pressure services.

DURABLE

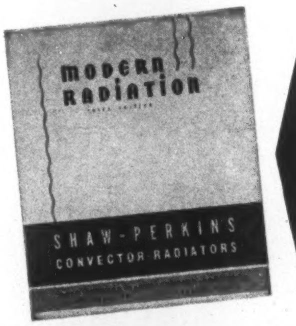
Substantial construction assures long life!



SHAW-PERKINS HEATING UNITS

When you specify and install Shaw-Perkins radiators, you automatically guarantee long years of highly satisfactory heating performance. The substantial steel construction, with the heating element enclosed in a heavy corrosion-resistant tube, is full proof of the durability of Shaw-Perkins radiators—and the attractive, conservative styling is insurance against obsolete appearance later on.

The elimination of the possibility of annoying and expensive service calls means you'll enjoy your full margin of profit and gain the confidence and recommendations of your customers. Why not acquaint yourself today with the modern Shaw-Perkins line? Full information gladly sent on request.



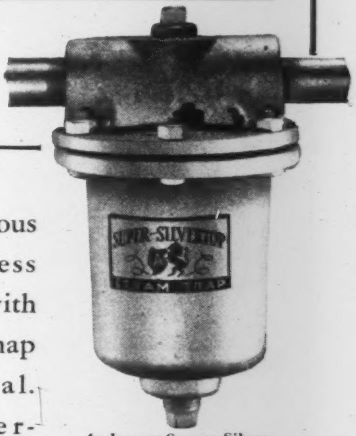
Write Today for this Booklet

SHAW-PERKINS MFG. CO.
Oliver Building
PITTSBURGH, PENNSYLVANIA

NOW—when minutes matter more...save them with SNAP ACTION HEAT

	PER BATCH OLD TIME	PER BATCH NEW TIME	MINUTES SAVED
VULCANIZER AT A RUBBER CO.	45	25	20
AUTOCLAVE IN TEXAS FACTORY	50	35	15

These are typical of many other cases



Anderson Super-Silvertop Steam Trap

● Save those precious minutes on process time! Save them with instant heat from snap action air removal. Anderson Super-Silvertop Steam traps equipped with snap action Air Eliminator get the air out fast. That lets *steam in* fast so that equipment reaches desired temperatures in minimum time.

Two typical time savings are shown in the table above—respectively 20 and 15 minutes saved per batch. You can make these savings too with *Snap Action* heat. Find out about it now—write for "How To Choose A Steam Trap"—it gives complete information. Don't waste more minutes, do it now.

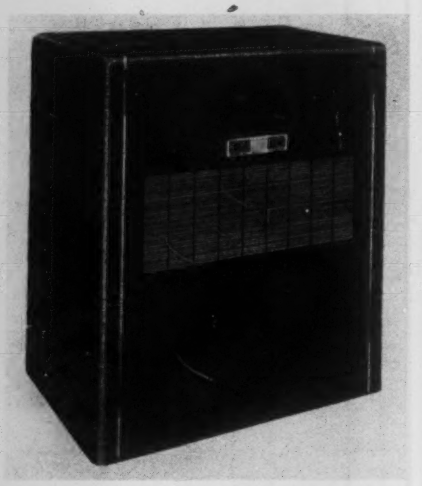
THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland, Ohio

Super-Silvertop
STEAM TRAPS

The gaskets are made in either natural or synthetic rubber, the latter having special application on oil lines where the solvent action might affect the natural rubber but would leave the synthetic unaffected.—Flexlock Corp., 411 E. Market St., Akron, Ohio.

Packaged Air Conditioning Unit

No. 2152—Especially designed for small stores, office suites, residences and similar applications, a new air conditioning unit—known as the "Type SU-20 Unitaire"—provides year 'round service. A steam or hot water heating coil may be added for winter operation. Although designed for operation in the space to be air conditioned, it may be remotely situated with ducts connected.



The cabinet of 16 ga steel houses all of the mechanism and is built in one section. Only 45 in. high, the unit may be installed on low wall cases or shelves to save floor space.

Two reciprocating condensing units are used. One or both of these may be operated for close control of temperature and humidity under varying load conditions. Concentric tube water cooled condensers cool as well as condense the "Freon" refrigerant. The centrifugal blower fan, driven by a $\frac{1}{3}$ hp motor, delivers 1000 cfm, the maker states.

Safety features include a spring loaded valve which will open, in case of abnormally high discharge pressures, to the low side of the refrigerant system. The valve closes automatically when normal pressures are resumed.—Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Vibration Isolation

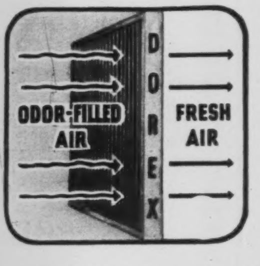
No. 2153—Designed for specialized services, three additional new "Vibro-Insulators"—mountings of rubber and metal to isolate vibration—were announced last month.

Type 44 is for use with gas burners, type 50 is specially engineered to isolate internal combustion engines against torsional vibration and type 60 is for isolating the vibration and noise of exhaust and intake fans.—B. F. Goodrich Co., 548 S. Main St., Akron, Ohio.

Insulation

No. 2154**—Some years ago the surplus marketing division of the department of agriculture initiated the manufacture of cotton insulation in order to help southern cotton growers dispose of surplus stocks, which, if successful, would mean the consumption of a fairly large part of the excess cotton supply. The program was intended to open new uses for the staple, put more men to

TRADE SMILES FOR SMELLS



Controlling odors is as much a part of air conditioning as the blowers, filters and humidifiers which you are installing every day. But don't let odors fool you. They can't be conditioned by refrigeration, washing, masking or circulation. They must be removed!

There is but one economical scientific method of odor control—complete elimination by means of Dorex Odor Adsorbers. Dorex units employ highly activated coconut shell carbon which unfailingly removes odors from the air, condenses and holds them through the process of adsorption. With Dorex, only air *fit* for human consumption is recirculated.

Look around you. There may be an opportunity to tackle the odors in the bakery across the street, in the store around the corner, in the theatre you patronize. Don't forget the factories in your city, the schools, restaurants, hotels and hospitals. There's business to be had both in existing buildings and in new ones now in the blueprint stage.

Wherever there is an odor problem, there is a Dorex solution and, of course, a profit for you. You trade smiles for smells when you install Dorex Odor Adsorbers, for no matter how you look at it, odor-*free* air means more satisfied clients, lower ventilation costs—and these mean more profits.

Dorex success stories in Bulletin H-8 will give you food for thought. Photographs and complete descriptive data on Dorex package and portable units are also included. Another bulletin explains what Dorex Odor Adsorbers mean to air conditioning and gives vital facts and figures on actual savings. Either or both are available on request. WRITE FOR YOURS TODAY!

DOREX
DOREX

"WORKS LIKE A GAS MASK"

DOREX

Reg. U. S. Pat. Off.

ODOR ADSORBERS

DOREX DIVISION
W. B. CONNOR ENGINEERING CORP.
114 East 32nd Street, New York, N. Y.

FOR ODOR-CONTROL IN AIR CONDITIONING, COMMERCIAL VENTILATION AND INDUSTRIAL PROCESSING

work, and safeguard the livelihood of many thousands engaged in cotton production.

There was introduced to the market in April of this year a new insulation called "Reyn-O-Cell," made of water repellent cotton treated so as to be flame proof and fire resistant.

The new cotton insulation is an effective sound deadening material, adaptable for partitions, floors and ceilings where sound isolation is desired, it is stated. Its fire resistant qualities extend far beyond the danger point, as it will withstand a temperature of over 1500 F without flaming, according to the manufacturer.

It has been estimated that between 225,000 to 500,000 bales of cotton could be consumed each year as an insulation material, without taking over more than 10 per cent of the insulation market as it now exists, and without considering the expansion in insulation sales that occurs every year.—Reynolds Metals Co., Inc., Federal Reserve Bank Bldg., Richmond, Va.

Useful Information

Refrigeration Codes

Standards for Refrigeration, an 8 p. circular issued by the American Society of Refrigerating Engineers, 37 W. 39th St., New York, N. Y., presents in a condensed and convenient form descriptions of the numerous refrigeration and air conditioning standards which members of the society have compiled, written, sponsored and revised during the past several years.

Different ASRE codes are described individually in short sections which give in each case the personnel of the committee who wrote the code, a history of its development, adoption and, in some cases, recent revision. Line cuts explain the salient features of some of the standards. The standards covered include those on air conditioning equipment, portable air conditioning units, compressors, condensers, comfort conditions, condensing units, heat exchangers, locker plants, milk coolers, refrigeration piping, moisture removal, the plant test code, and the one most widely known, the refrigeration safety code.

Book Reviews

Air Conditioning Manual

[Trane Air Conditioning Manual. 2nd ed. 1941. 376 + xix pp., 8½ x 11 in., clothbound. Published by The Trane Co., La Crosse, Wis. Price, $5.00.]

The second edition of this outstanding handbook and text on air conditioning practice features an entirely new and comprehensive chapter dealing with ducts and fans. Such subjects as measurement of air pressure in ducts, total static and velocity pressure, fan horsepower, outlet velocity and many others are covered in detail. A separate printing of the new chapter on ducts and fans—complete in itself—has been made and is generally available for $1.00, or for 50c to those who have purchased earlier editions of the manual.

MATERIALS, MEN, METHODS... all three contribute to INSULATION EFFICIENCY

←

Charity Hospital, New Orleans, La. *Architect,* Weiss, Dreyfoss & Seiferth, New Orleans. *General Contractor,* George A. Fuller Co., New York, N. Y. *Distributor,* C. T. Patterson Co., New Orleans. *Approved Insulation Contractor,* American Plumbing & Heating Co., New Orleans. Materials used: Air Cell, Woolfelt, 85% Magnesia.

RU-BER-OID SUPPLIES ALL THREE!

Safeguard insulation efficiency at all times by getting the combined value of excellent materials, men and methods. Ruberoid offers you all three. Proper products to meet each specific problem. Hand-picked men skilled in insulation application. Sound engineering counsel to accomplish maximum results at a minimum cost.

Materials. The Ruberoid line of insulation materials offers a complete selection of quality products for sub-zero to 1900°F. temperatures. Ruberoid insulations are furnished in forms of sectional pipe covering; sheets; blocks; blankets; cement; papers; boards and felts. The materials are No. 19 High Temperature, Rock Wool, 85% Magnesia, Laminated Asbestos, Air Cell, Woolfelt, Anti-Sweat, Cork and Hairfelt.

Men. Throughout the country Ruberoid has Approved Applicators—organizations known and respected for their knowledge of insulation and careful workmanship. These applicators are hand-picked, able, well-qualified to serve you. They are of the highest type in the industry.

Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

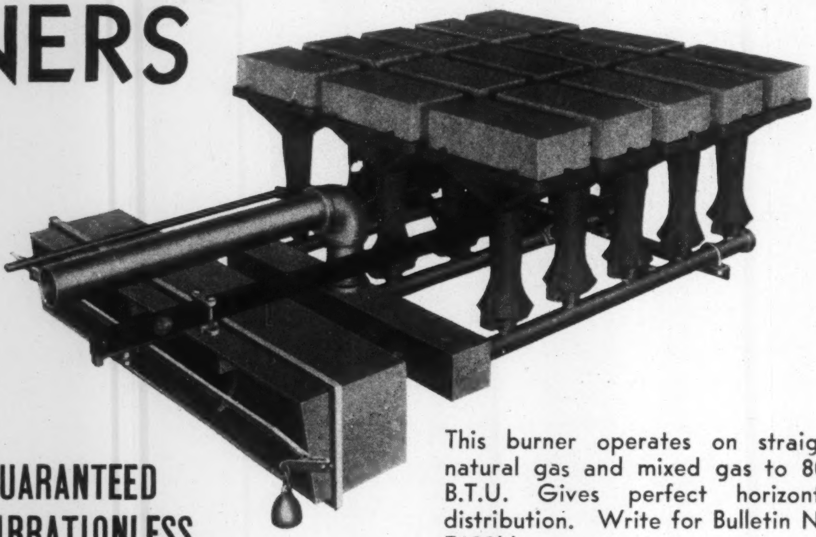
Get All Three. On the next job get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for Ruberoid's latest Insulation Catalog. Invaluable as a reference guide. Address The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Dept. HPC-8.

RU-BER-OID Insulation

For HEATING · COOLING · AIR CONDITIONING

WECO-N.G.E. Series F600 GAS BURNERS

These burners are available for ratings from 50,000 to 10,000,000 B. T. U. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler. Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.



GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.T.U. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.
TULSA —DIVISION OF— **OKLAHOMA**
Surface Combustion Corp. . . . . Toledo, Ohio

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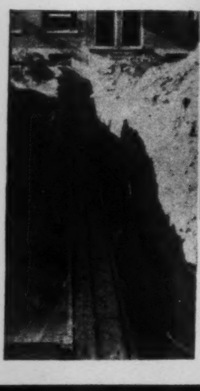
ADSCO-BANNON CONDUIT
TILE CONDUIT FOR UNDERGROUND LINES

(Below) Insulated steam lines in place and ready for top of conduit and backfilling.



(Above) Bottom half of conduit and base drain with pipe supports and saddle plates ready for steam pipe installation.

(Below) Completed conduit installation ready for backfilling operation.

REASONABLE IN COST— EASY TO INSTALL

PROMPT SHIPMENTS, USUALLY FROM STOCK

ADSCO-Bannon Tile Conduit for underground steam and hot water lines is a strong, vitrified product available with or without base drain in sizes from 4-24" inclusive. In combination with ADSCO Filler Insulation—a "Fiberglas" product, it is very reasonable in cost, easily installed with a minimum of field engineering and makes a permanent installation of high thermal efficiency. Most orders can be shipped promptly from ample stocks or shortly after receipt of order at the tile factory.

Send details of installation for quotation or write for Bulletin No. 35-67 HP.

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

This new edition of the manual has been printed in the same attractive and easy to read format of its predecessor, and contains a wealth of essential and practical data. In addition to the new chapter on ducts and fans, there are chapters on heat, comfort, heat gains, properties of air and the psychrometric chart, calculations for the conditioned air supply, refrigeration and air conditioning, and water for air conditioning. There are extensive tables and charts arranged and indexed for easy reference, and numerous illustrations are presented throughout the text.

The primary purpose in assembling and presenting the material in this book has been to give it in such a manner that the student will obtain a well organized, coherent grasp of the subject and a clear picture of the simple relationships existing between the many apparently complex principles involved in the design of an air conditioning system, according to the publisher. It seems safe to say that this objective has been achieved.

Coming Events

National Industrial Advertisers Association: Annual conference, September 17-19, Royal York Hotel, Toronto, Canada. Headquarters office, 100 E. Ohio St., Chicago, Ill. Program includes talk by Willard V. Merrihue, General Electric Co., on the planning, execution and results of a promotion campaign for motors; an address on industrial advertising in a wartime economy, by Horace T. Hunter, MacLean Publishing Co., Ltd.; clinic on successful operation of an NIAA chapter; address "Are Industrial Buyers People?", by Forrest U. Webster, MacManus, John & Adams, Inc.; and others.

American Welding Society: Annual meeting, week of October 19, Bellevue-Stratford Hotel, Philadelphia, Pa., in conjunction with the National Metal Exposition at the Commercial Museum, Philadelphia. Headquarters office, 33 W. 39th St., New York, N. Y. Technical sessions are scheduled on piping and pressure vessels, weldability of plain carbon and low alloy steels, welding of high alloy steels, shipbuilding, railroad welding, aircraft and automotive welding, resistance welding, national defense, and machinery welding.

American Society of Refrigerating Engineers: Annual meeting, December 3-6, St. Louis, Mo. Headquarters office, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 26-30, Philadelphia, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

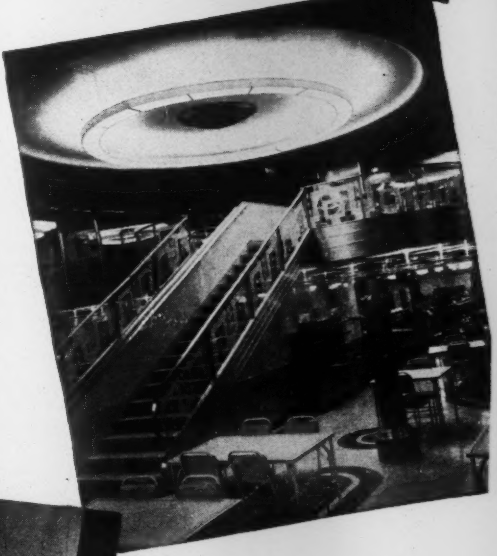
Seventh International Heating and Ventilating Exposition: January 26-30, Commercial Museum, Philadelphia, Pa. Under auspices American Society of Heating and Ventilating Engineers and under management International Exposition Co., Charles F. Roth, president, Grand Central Palace, New York, N. Y.

Unparalleled Results Produce Flow of Recommendations for ANEMOSTAT DRAFTLESS AIR DIFFUSERS

The exacting clients of leading engineers insist upon perfect performance of an air conditioning installation. Perfect performance depends largely upon perfect distribution of the conditioned air. After study of their performance, leading engineers therefore select ANEMOSTAT Draftless Air Diffusers which, experience has proved, give unparalleled results in draftless air distribution.

Thousands of ANEMOSTATS are installed in America's foremost factories, office buildings, theatres, schools, stores, etc.

Faultless Air Distribution means draftless distribution of the heated, cooled or ventilation air, the equalization of temperature and humidity and the prevention of stale air pockets in which the air is either too hot and too dry, or too cold and too humid.



ANEMOSTATS can be used on new or existing installations.

ANEMOSTATS produce these unparalleled results because they are the ONLY air diffusers which operate on the following interdependent principles:

1 Air Expansion within the device, which reduces velocity instantly.

2 True Aspiration, which causes room air to be drawn into the device where it is mixed with the supply air.

3 Creation of a multiplicity of air currents and counter-currents at low velocities, which causes slow but adequate secondary air motion.

ANEMOSTAT
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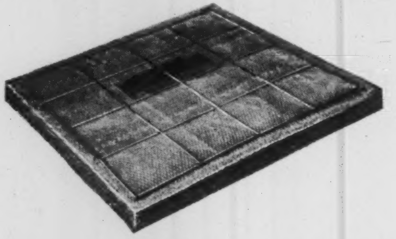
10 East 39th Street · New York, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

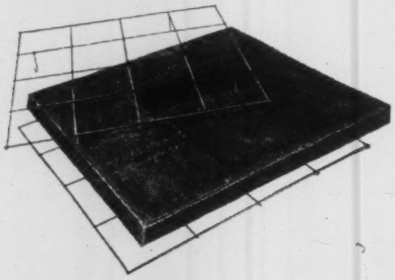
"NO AIR CONDITIONING SYSTEM IS BETTER THAN ITS AIR DISTRIBUTIO

Performance Insurance . . .
for Your Heating and Air Conditioning Equipment



Research Air Filters Give Maximum Efficiency with Low Air-Flow Resistance

Leading manufacturers of heating and air conditioning equipment are standardizing on RESEARCH AIR FILTERS . . . because they remove 93% of standard code dust . . . have high dust-holding capacity and low air-flow resistance. For top quality performance, supply RESEARCH AIR FILTERS with your equipment!



Illustrations show one of several types of Re-Fil-Able Filters used in warm air furnaces, air conditioning units, filter banks. Top picture, assembled unit. Below, filter pad and hooked wire grids disassembled.

WRITE FOR COMPLETE DATA UNITS AND CATALOG SHEETS TODAY!

RESEARCH AIR FILTER

RESEARCH PRODUCTS CORP.
Madison Wisconsin

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 118. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 3933 AIR CONDITIONERS: Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J. 2 p. data sheet (C-1100-S23A) on "PC Series" unit air conditioners, giving specifications, capacities and dimensions, with information on auxiliary equipment.

No. 3934. AIR CONDITIONERS: Trane Co., La Crosse, Wis., 12 p. bulletin (DS-362) on self-contained air conditioners, describing features, giving specifications, and showing diagrams and cut-away illustrations of installations, dimensions and control.

No. 3935. ALUMINUM: Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa. 56 p. booklet on forming aluminum. Data on available alloys, blanking and piercing, drawn shapes, spun shapes, shape forming and embossing, coining and stamping are included.

No. 3936. BEARINGS: Keystone Carbon Co., Inc., St. Marys, Pa. 24 p. catalog on "Selflube" porous bearings, describing properties and uses of these self-lubricating bearings and giving details on correct method of installation.

No. 3937. BOILERS: Spencer Heater Div., Aviation Mfg. Corp., 164 Park St., Williamsport, Pa. Series of mailing cards used in "heating clinic" campaign, dealing with various heating problems, and illustrated with various types of boilers which are offered as "prescriptions" for solving such problems.

No. 3938. CHEMICAL AND PROCESS EQUIPMENT: Patterson-Kelley Co., Inc., East Stroudsburg, Pa. 8 p. bulletin on chemical and process equipment, illustrating various types of tanks and pressure vessels, kettles, mixers, shell and tube heat exchangers, and miscellaneous equipment.

No. 3939. COMPRESSORS: Trane Co., La Crosse, Wis. 16 p. bulletin (DS-361) on reciprocating compressor units for air conditioning, describing features, illustrating and discussing the various types, and giving piping arrangements, mechanical specifications and data on capacity, dimensions, etc.

No. 3940. COMPRESSORS: Trane Co., La Crosse, Wis. 24 p. bulletin (S399) on turbo-vacuum compressors for large air conditioning installations, describing features, illustrating and discussing the 50, 70, 100 and 200 ton models, and presenting data on control arrangements, cycle of operation, dimensions, and various specific installations.

Everdur takes over

WHERE OTHER METAL COULDN'T STAND THE GAFF

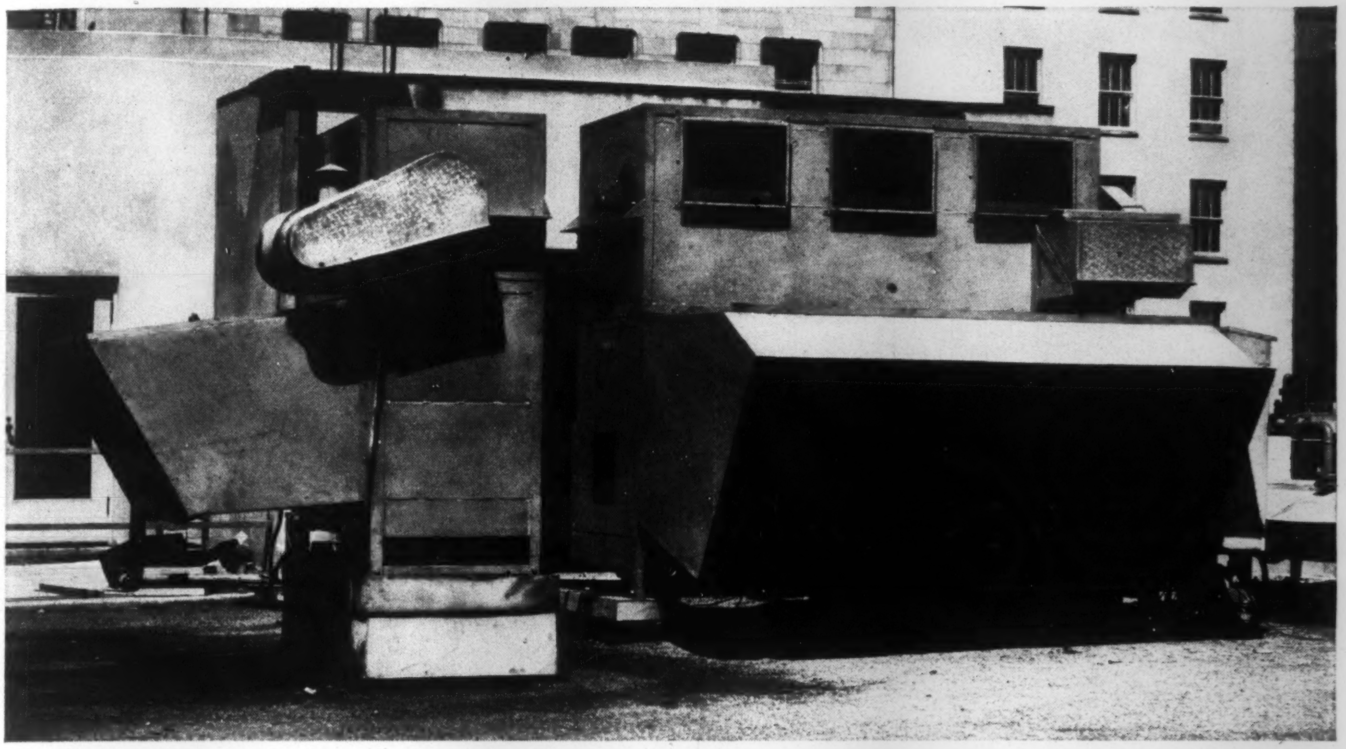


Photo shows rooftop installation of Everdur evaporative condensers for air-conditioning system of the Insurance Company of North America Building, 222 Sansome Street, San Francisco, California. James A. Nelson, Inc., of San Francisco was the contractor. Hunter & Hudson, same city, were the consulting engineers.

3,800 pounds of copper-silicon alloy provide permanent "rust insurance" for the condensers of this mammoth refrigerating system

IN the operation of this air-conditioning system, the refrigerating compressor discharges the gas into a coil in the condenser which is kept wet by a system of piping, supplying water on the exterior of the coils. Fans draw outside air into the filters and circulate it over the above mentioned coils.

Thus, the air in this condenser is not only quite warm, but is highly charged with moisture as well. And for those reasons it has a highly corrosive effect on the metal of the condenser housing. As a matter of fact, the original condensers, constructed of rustable metal, lasted only about three years.

The problem, then, was to find a metal able to withstand this highly corrosive action and one which could also be readily fabricated. Everdur* was selected as the ideal metal.

This rugged metal, the American Brass Company's copper-silicon alloy, combines tensile strength comparable to mild steel with corrosion resistance equal to or better than that of copper. It is unusually workable, and can be readily welded by well-established procedures. With all its advantages, Everdur is moderately priced, a fact which has led to its extensive use in air-conditioning and refrigerating applications.

*Everdur is a trademark of the American Brass Company, registered in the U. S. Patent Office. 41163

ANACONDA **Everdur** (COPPER-SILICON) **METAL**

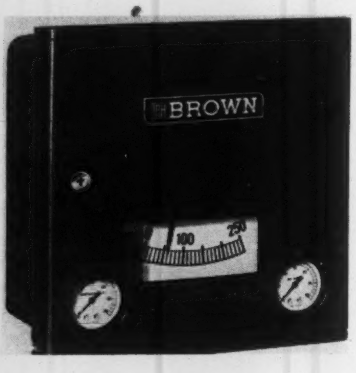
THE AMERICAN BRASS COMPANY, General Offices: Waterbury, Connecticut
Subsidiary of Anaconda Copper Mining Company • In Canada: Anaconda American Brass Company, Ltd., New Toronto, Ont.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Pneumatic Transmitting System

No. 2155—The development of the differential "New-Matic" transmitting system for measuring differences in temperatures, flows, levels, pressures, etc., was recently announced. The system consists of two measuring elements equipped with pneumatic transmitters, each of which delivers an air pressure proportional to the measured variable, and a differential pressure detector employing a mercury filled U tube and a float actuating a recording or indicating pointer. Where the differences are large, a wide range can be covered and where they are small, minute changes can be observed, the manufacturer states. The two transmitters may be as much as 500 ft apart.



Applications include controlling, and indicating or recording the following:

Difference in inlet and outlet temperatures on feed-water heaters, condensers, air preheaters, heat exchangers, etc.

Difference in inlet and outlet temperatures of water for heating or cooling of buildings or tanks.

Difference in inlet and outlet temperatures on superheater, thus giving the amount of superheat directly.

Difference in inlet and outlet temperatures on economizers, thus giving heat recovery directly.

Difference in inlet and outlet temperatures on bearings, lubrication systems on turbines, diesel engines, rolling mills, etc.

Difference in wet and dry bulb temperatures (combined with the dry bulb record), thus simplifying humidity calculations.

Difference in temperature between the top and bottom of a tower or tank.

Difference in flows from two reservoirs, boilers, tanks, etc.

Difference in levels in two remote tanks.

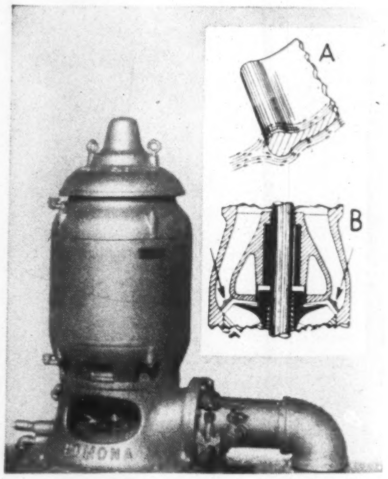
Difference in outgoing and return flows in circulating systems.

Difference of pressures in two remote pipe lines.

Difference of pressures in two closely associated pipe lines where fluid from one line may not be permitted to enter the other.—Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.

Vertical Turbine Pumps

No. 2156—Patents have recently been granted covering design improvements which eliminate hydraulic losses in pumps, thereby increasing efficiency, according to the manufacturer's announcement. These improvements, now included in all sizes of the maker's vertical turbine pumps, involve fundamental design changes in the guide vanes, function of which is to alter, from horizontal to vertical, the flow direction of fluids being pumped.



By forming these advanced vane ends of a bulbous shape, it was discovered that regardless of the flow direction of the fluid, its direction would always be substantially tangential to the vane surface, it is stated. Thus uniformity of flow pattern is secured, friction is reduced and efficiency of fluid lift is increased. Furthermore, because of the recessive curve at the rear of the bulb shaped vane, eddy currents are not developed.—Pomona Pump Co., 206 E. Commercial St., Pomona, Calif.

Semi-Refractory Cement

No. 2157—A new air setting, semi-refractory cement for protecting insulation exposed to the erosive action of hot gases sets quickly without the application of heat, and

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FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [9-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2155 2156 2157 2158 2159 2160 2161 2162 2163 2164
2165 2166 2167 2168 2169 2170
3966 3967 3968 3969 3970 3971 3972 3973 3974 3975
3976 3977 3978 3979 3980 3981 3982 3983 3984 3985
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Name .... Title ....
Company ....
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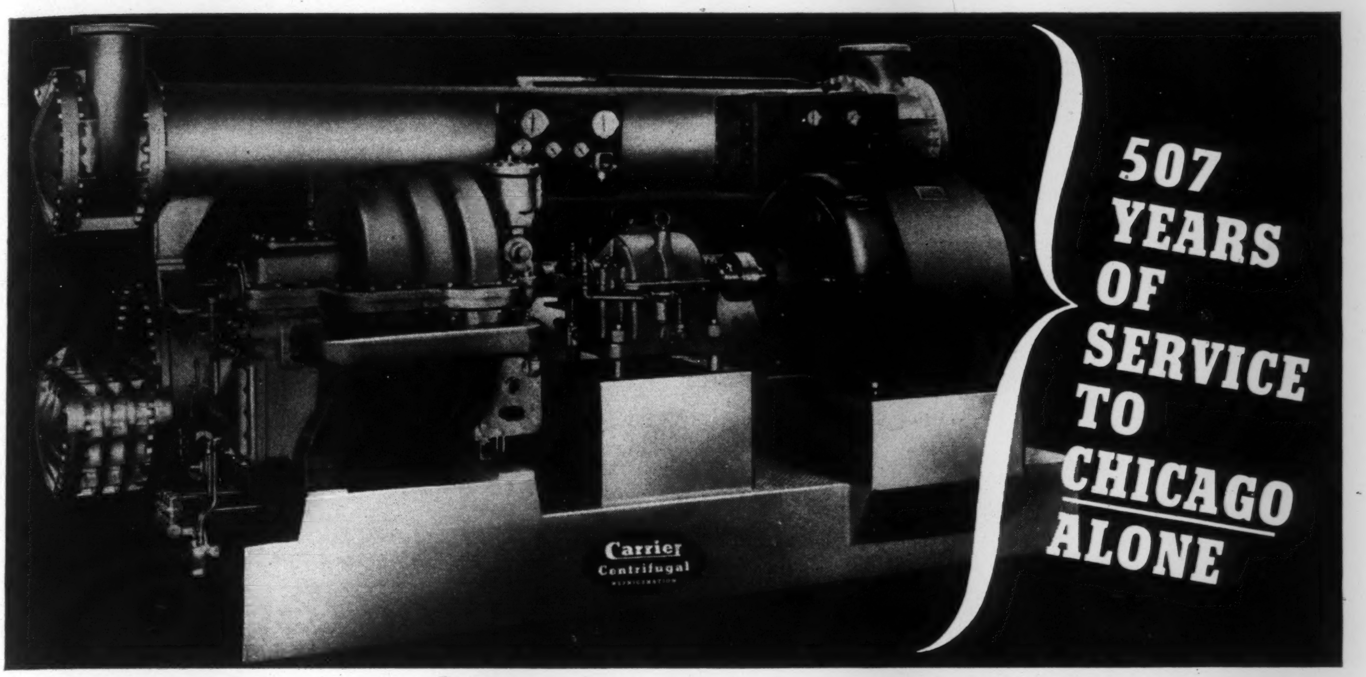


60 Machines produce 12,436 tons of refrigeration in Chicago daily

Carrier
Centrifugal
REFRIGERATION

THIS IS TYPICAL OF ALL MAJOR CITIES

(List of Installations in Chicago)

Owner	*Date Installed*	*Tons*
Adler Planetarium	1933	41½
American Decalcomania	1937	76
Avalon Theatre	1926	175
Brunswick Balke Collender Co.	1937	90
Bunte Bros. Candy Co.	1940	165
Bunte Bros. Candy Co.	1941	320
Capitol Theatre	1925	135
Chicago Athletic Asso.	1937	75
Chicago Park District	1940	300
Chicago Stadium (2)	1928	238
Chicago Title & Trust Co.	1929	300
Cohan's Grand Theatre	1925	85
Columbia Malting Co.	1941	290
Conway Building	1940	350
Cooley's Cupboard, Inc.	1931	38½
Curtis Candy Co.	1931	53
De Met's Rest.	1933	30½
A. B. Dick Co. (2)	1929	395
A. B. Dick Co.	1934	165
A. B. Dick Co.	1937	135
R. R. Donnelley & Sons Co.	1929	167
R.R.Donnelley&SonsCo.(2)	1933	105
R. R. Donnelley & Sons Co.	1941	150
Fair Store	1936	177½
Field Estate Bldg. (3)	1931	675
International Harvester Bldg.	1937	380
S. S. Kresge, 10 So. State St.	1936	142
S. S. Kresge, 63rd & Halsted Sts.	1937	220
La Salle Hotel	1937	200
Madigan Brothers	1938	119
Mandel Brothers	1934	286
Mandel Brothers	1936	335
Marshall Field & Co. (Oak Park)	1937	235
Marshall Field & Co. (2)	1941	1000
Merchandise Mart	1937	371
Merchandise Mart	1940	525
Merchandise Mart (Henrici Restaurant)	1941	550
Meyercord Company	1926	98
National Broadcasting Company	1941	270
Northern Trust Co.	1929	175
Northern Trust Co.	1938	80
310 So. Michigan Ave.	1940	170
Palmer House	1937	850
Paradise Theatre	1928	246
Pittsfield Bldg.	1938	150
Shedd Aquarium, J. G. (3)	1928	330
Triangle Restaurant	1931	63
University of Chicago	1937	100
Wesley Memorial	1940	72
Wieboldt Stores, Inc.	1939	150
Woolworth Co., F. W.	1933	237
Wrigley Building	1940	350

ASK FOR LIST OF INSTALLATIONS IN YOUR CITY ☛

Experiment? Not the *Carrier* Centrifugal Refrigeration Machine. Behind the latest 1941 model stand over 20 years of continuous world-wide experience with 1000 installations. And these installations cover the widest possible variety of industrial refrigeration and air conditioning uses!

From the very beginning, Carrier Centrifugal Machines have been successful—a visit to the Onondaga Pottery Co., Syracuse, N. Y., will show you the original Centrifugal Refrigeration Machine in everyday operation since 1924. Straight through the years, as each new model succeeded the old, Carrier has perfected new improvements—in design, in application of materials, in manufacturing methods.

For trouble-free operation . . . maximum efficiency . . . and the lowest possible operating costs, insist on time-tested Carrier Centrifugal Refrigeration for your installation.

CARRIER CORPORATION, Syracuse, N. Y.
"Weather Makers to the World" Desk I38

Without obligation, please send me free booklet, "Carrier Centrifugal Machines Through the Years" together with a list of Carrier Centrifugal Refrigeration installations in this area.

Name..
Address..
City.............................. State..............

VE OIL and MOISTURE
from STEAM and AIR
with
COCHRANE
SEPARATORS & PURIFIERS

Keep the Steam
You Use CLEAN
and DRY
Keep Compressed
Air PURE

HORIZONTAL ALL-SERVICE SEPARATOR

For Horizontal Pipe Lines
•
For Exhaust Steam
Live Steam • Compressed Air
The most popular all-service separator on the market. Thousands in use. Adapted to restricted locations.

VERTICAL ALL-SERVICE SEPARATOR

For Vertical Down-Flow Pipe Lines
•
For Exhaust Steam
Live Steam
Compressed Air
Highly efficient • One-piece Construction • Self-Cleaning • Low in Cost

LOW-PRESSURE SEPARATOR

For Pressures up to 75 lbs.
For Exhaust Steam • Low-Pressure Live Steam
Exceptionally Large Port Area
• Self-Cleaning • Welded Construction

RECEIVER SEPARATOR

Wherever large quantities of water are to be expected.
Receiver takes care of extra large flushes of water due to condensation in pipe lines.

STEAM PURIFIER

The danger and inefficiency of wet dirty steam and slugs of water due to priming and foaming are eliminated with the installation of a Cochrane Purifier. Boilers have often been doubled in capacity by this simple method delivering dry pure steam at higher pressures.

Descriptive Bulletins with tables of sizes and capacities will be mailed on request. Write today stating type of equipment you are interested in, or nature of purification problem.

COCHRANE CORPORATION • 3131 N. 17th STREET, PHILADELPHIA, PA.

COCHRANE

WATER SOFTENERS • STEAM SPECIALTIES • DEAERATORS • FLOW METERS

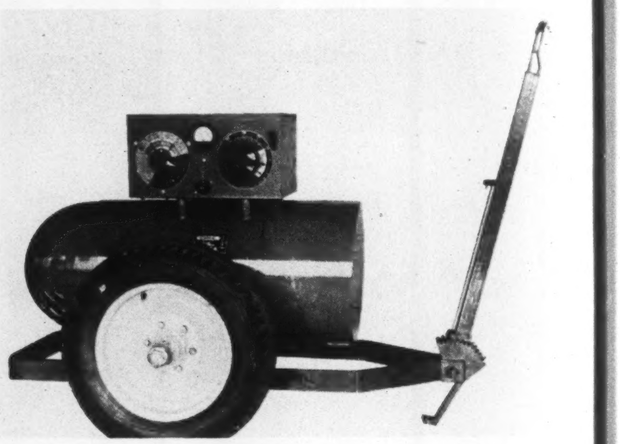
was developed especially for use over flue, breeching and stack linings—where it is often impossible to introduce heat for some time after the cement has been applied—the maker states.

It is described as a fibrous, hydraulic setting material having a minimum covering capacity of 20 sq ft, 1 in. thick, per 100 lb. The cement has high resistance to moisture and corrosive acid vapor, and does not shrink in area during settling, according to the manufacturer.—Johns-Manville, 22 E. 40th St., New York, N. Y.

Welding Machine Trailer

No. 2158—A new two wheeled, light weight, pneumatic tired trailer for mounting arc welding machines for easy, fast portability in shop, yard or on the road, was announced last month.

Designed for mounting either the maker's "SAE" 200 to 600 ampere a-c motor driven or "Type SA 200" special engine driven arc welders, the new unit can be used for road towing up to approximately 30 mph, can be hitched to a factory mule or industrial truck and is easily moved by hand by virtue of the low, underslung construction, narrow 31 in. tread and method of balancing. It is of arc welded steel construction throughout.



Mounting is accomplished by means of four bolts in the frame of the trailer which register with holes in lugs on the welding machine.

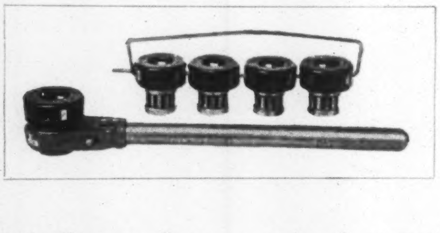
The combination tow bar and standing support has a hand operated ratchet arrangement for locking the support arm in position.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Diestocks With Segmental Dies

No. 2159—Substantial economies in time, energy and costs are represented as advantages of two new diestocks with segmental dies, according to the manufacturer.

The drophead ratchet diestock, made in two sizes and covering a range of ⅛ to 1¼ in. is designed to get into inaccessible corners. Its enclosed collar protects the ratchet mechanism from dirt and chips.

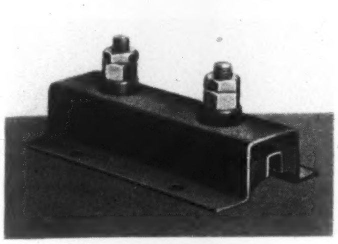
Each of the new three way diestocks serves as three stocks in one tool. It is supplied for ⅜ to ¾ in. and ½ to 1 in. pipe or with special dies for brass pipe or conduit. Die changing on the job is eliminated because



the most frequently used sizes are in the stock ready for use. The user can insert any three sets of segmental dies at once—three dies for three sizes of pipe, or a die for conduit, copper or brass can be combined with two others for several purposes.—Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.

Vibration Isolators

No. 2160—Several new types of isolators employing rubber as a cushioning medium have been announced by the manufacturer of a complete line of natural cork and steel spring resilient mountings for reciprocating and rotating machinery. According to the manufacturer, they should be of particular interest to users and builders of small engines and relatively light weight machinery.



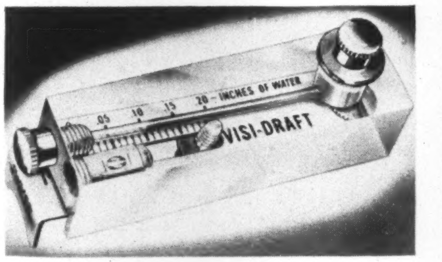
Load capacities for individual shear type units range from 25 to 450 lb and if necessary, two or more of the mountings may be combined in steel housings when greater load capacities are required.

The compression type of mounting is suitable for concentrated loads and should be used wherever the lesser deflection of rubber in compression is permissible. Load capacities range up to 1200 lb per mounting and if desired, this unit may be used as a shear mounting by bolting the base plate in a vertical direction.

Rubber mountings are also available in extended structural integral bases. Thus, a common sub-base for driving and driven machinery can be provided with which alignment between two machines can always be maintained. Proper load distribution is achieved by correctly spacing the isolators within the steel members.—Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.

Draft Gage

No. 2161—A new draft gage (known as the "Visi-Draft") is a practical instrument for use in the field, the manufacturer states, and readings are taken from above making it possible to place the instrument on a table, floor or wherever convenient. Location of the scale directly below and close to the indicating tube eliminates the possibility of error from parallax, it is stated.



The leveling bubble is set in a polished bore in the body of the gage where it is protected, but visible from all angles. Level and zero scale adjustments are made simultaneously.

The scale is graduated to 0.01 in. divisions. All bores are drilled and reamed in a solid block of clear plastic and with the exception of the leveling bubble, no glass is used. The instrument comes in a carrying case which fits the coat pocket.—F. W. Dwyer Mfg. Co., 565 W. Washington Blvd., Chicago, Ill.

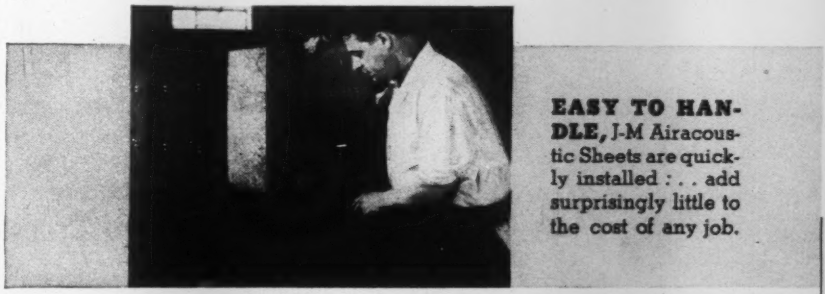
DIVIDENDS from QUIET...

FEDERAL LOAN AGENCY BUILDING, (Lafayette Building) Washington, D. C. Here, as in hundreds of other buildings all over the country, J-M Airacoustic helps assure a quiet duct system.

Duct linings of Airacoustic Sheets eliminate unnecessary noise in airconditioning system of Federal Loan Agency Building . . . help make offices more comfortable and efficient

Even airconditioning systems that are mechanically perfect may cause trouble by acting as "speaking tubes" for noise. One sure way to eliminate such a possibility is to line ducts with J-M Airacoustic Sheets. More than 70% sound-absorbent, this modern lining material effectively prevents disturbing noise from being carried by ducts . . . makes offices quieter. Because Airacoustic Sheets are basically mineral, they will not support flame . . . introduce no fire hazard. And their high moisture resistance assures full protection against the dangers of humidity.

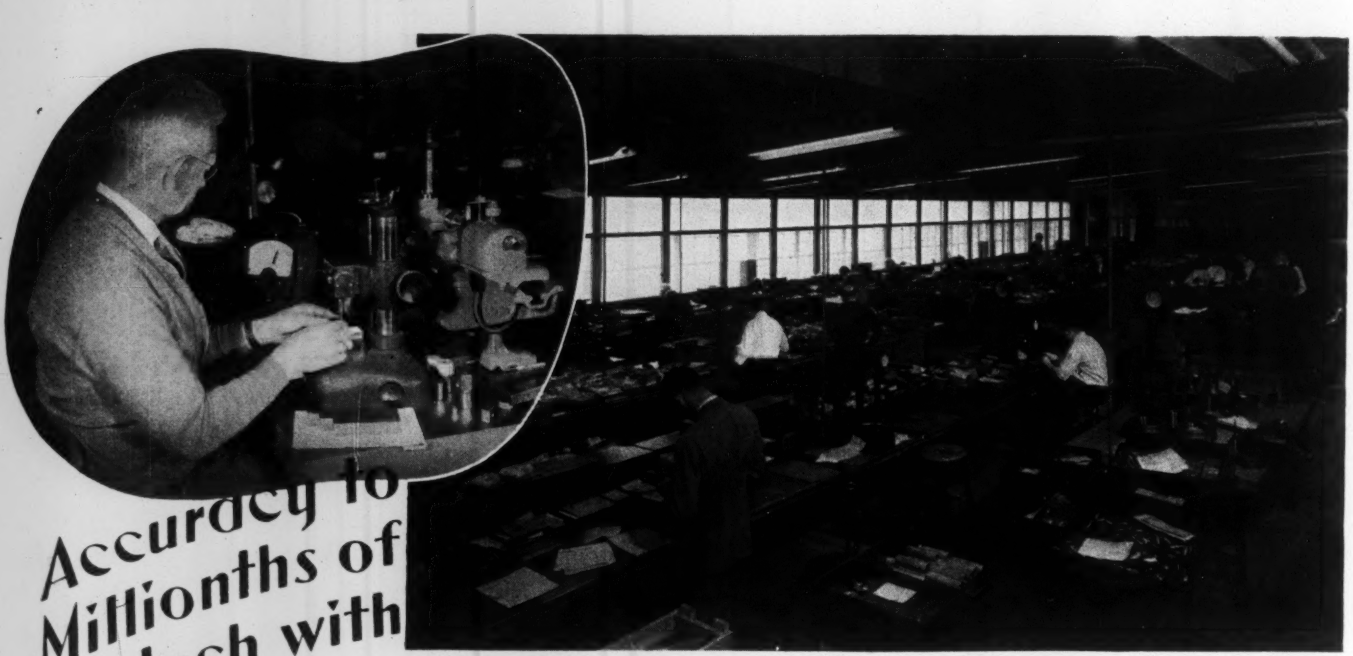
Installation of J-M Airacoustic Sheets is rapid and easy, for they are supplied in large, relatively light units. They add so little to the cost of any system that you can include their extra protection in every estimate. For details, write for brochure AC-23A. Johns-Manville, 22 East 40th Street, New York, N. Y.



EASY TO HANDLE, J-M Airacoustic Sheets are quickly installed : . . add surprisingly little to the cost of any job.

JM Johns-Manville

AIRACOUSTIC SHEETS FOR DUCT LININGS



Accuracy to Millionths of an Inch with

The parts for tanks, planes and guns, produced in thousands of separate plants, can only fit together properly if made in standard sizes, to accurate gages. Pratt and Whitney secure accuracy to millionths of an inch by finishing their Hoke precision gage blocks in this air conditioned room at West Hartford, Connecticut.

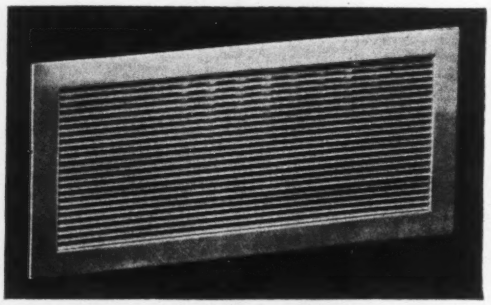
Standard conditions of 68° F. and 50% relative humidity are maintained, 24 hours a day the year 'round, with Frick Equipment. This working space, covering 16,800 sq. ft., is believed to be more accurately controlled than any other of like size in existence. Full credit is due the Automatic Refrigerating Co., Frick Distributors at Hartford.

Put your air conditioning problem up to the experts who have nearly 60 years' experience back of their recommendations. Write **FRICK CO., Waynesboro, Penna.**

TRADE **FRICK** MARK

Air Conditioning

THIS GRILLE IS DESIGNED FOR *extra usefulness*



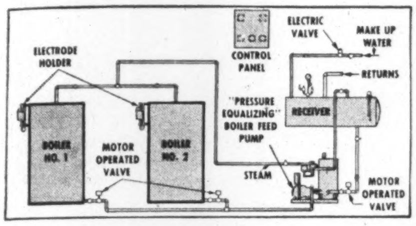
● Air conditioning men will quickly recognize the advantages of the Waterloo 1A Grille. Close-spaced fins on quarter-inch centers lend a smart appearance, provide extra strength, and effectively mask the duct. Rear blades are individually adjustable to control air direction 45 degrees either way. The 1A is a really efficient air conditioning grille, beautifully designed, so strong that it may be used in floor installations, and moderately priced. Write for complete details and free illustrated catalog.

Waterloo REGISTERS

WATERLOO REGISTER CO.
WATERLOO, IOWA • SEATTLE, WASH.
Representatives in principal cities

Water Control for Boilers

No. 2162—A new system of multiple boiler water control that—says the maker—maintains safe and proper water levels in two or more boilers with just one boiler feed pump, has been announced. Each boiler water level is controlled separately, and water added independently of the other boilers, as the need arises. The system is electrically controlled and completely automatic in operation. In the diagram reproduced here the electrical wiring is omitted.

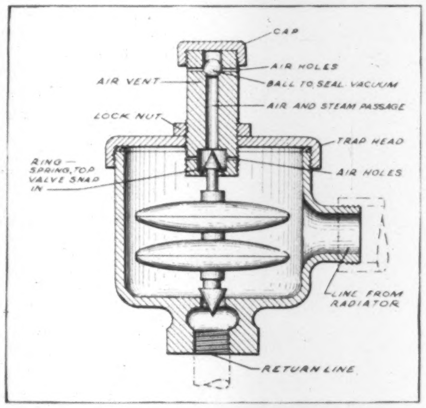


Two stationary electrodes, of different lengths, are mounted in a small holder on each boiler. When the water level in any boiler falls below the longer electrode an electric circuit is disturbed which, through a relay, starts the boiler feed pump. At the same time a motor operated valve is opened to divert the pump discharge into the boiler requiring water. When water level reaches the desired level the pump stops. When necessary all boilers can be fed simultaneously. Low water alarm or low water cut-off of stoker or burner can also be provided for each boiler.

This control is suitable for pressures up to 150 lb for all boilers up to 250 hp, and it can be used with any type of steam or motor driven boiler feed pump, according to the manufacturer.—Johnson Corp., 830 Wood St., Three Rivers, Mich.

Self Venting Vacuum Trap

No. 2163**—The self venting vacuum trap illustrated here has been designed specifically for the purpose of relieving congestion in steam systems by proper venting in order that the system will heat instantaneously and economically, according to the manufacturer. It allows the air to escape through the vent in the trap rather than to go into the return line in order to allow free access of steam to the radiator and prevent the radiator from becoming air bound.



The element has a valve on each end, and it expands and closes opposed seats at the same time. The ball valve seats when air is not escaping and prevents air from entering the system.—K. & M. Heating Specialties Co., Empire State Bldg., New York, N. Y.

Unusual Pipe Coil

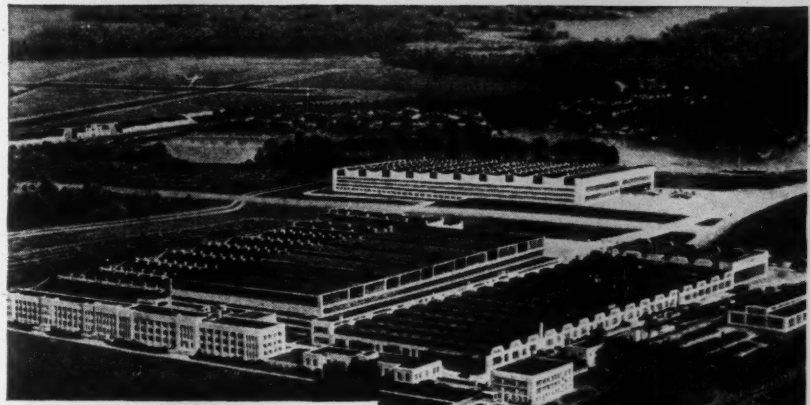
No. 2164—Although continuous pipe coils have been used in the refrigeration industry for many years, progress in the arts of pipe bending and welding and developments in design continue to be made. The coil illustrated

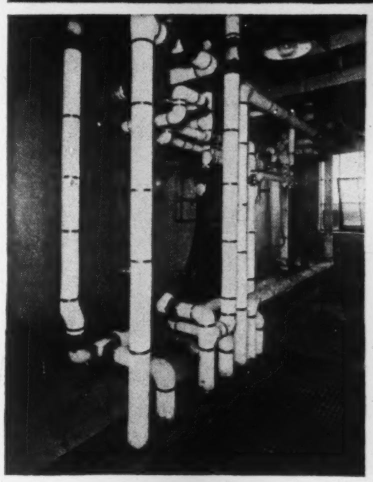
MATERIALS, MEN, METHODS

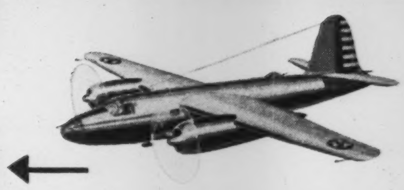
. . . all three contribute to

INSULATION EFFICIENCY

at the GLENN L. MARTIN COMPANY







Glenn L. Martin Company, Baltimore, Md. Boilers and Piping Insulated with 85% Magnesia. Hot and cold water lines, Ruberoid Woolfelt. *Architect:* Albert Kahn Inc., Detroit, Mich. *General Contractors:* Consolidated Engineering Company. *Plumbing and Heating Contractor:* Lloyd E. Mitchell, Inc. *Insulation Contractor:* The Standard Insulation Co., all of Baltimore, Md.

RU-BER-OID SUPPLIES ALL THREE!

As they build more airplanes for national defense, the Glenn L. Martin Company continues to expand its manufacturing facilities. With this expansion come miles of Ruberoid Insulation (pipe covering). To safeguard insulation efficiency, Ruberoid offers the combined value of excellent materials, men and methods. Proper products to meet each specific problem. Hand-picked men skilled in insulation application. Sound engineering counsel to accomplish maximum results at a minimum cost.

Materials. The Ruberoid line of insulation materials offers a complete selection of quality products for sub-zero to 1900°F. temperatures. Ruberoid insulations are furnished in forms of sectional pipe covering; sheets; blocks; blankets; cement; papers; boards and felts. The materials are No. 19 High Temperature, Rock Wool, 85% Magnesia, Laminated Asbestos, Air Cell, Woolfelt, Anti-Sweat, Cork and Hairfelt.

Men. Throughout the country Ruberoid has Approved Applicators—organizations known and respected for their knowledge of insulation and careful workmanship. These applicators are hand-picked, able, well-qualified to serve you. They are of the highest type in the industry.

Methods. And with the wide selection of materials and fine workmanship, Ruberoid offers you its own staff of engineers to help you cope with any insulating problem that may confront you.

Get All Three. On the next job get the combined value of excellent materials, men and methods. Give your client the maximum insulation efficiency. Send for Ruberoid's latest Insulation Catalog. Invaluable as a reference guide. Address The Ruberoid Co., 500 Fifth Avenue, New York, N. Y. Dept. HPC-9.

RU-BER-OID

Insulation

For HEATING · COOLING · AIR CONDITIONING

SUPER-SILVERTOP
STEAM TRAP
SUPER-SILVERTOP
STEAM TRAP

THE *Only* STEAM TRAP WITH ALL 4 FEATURES

1 CHOICE OF ELBOW OR STRAIGHT-IN-LINE CONNECTIONS

2 GUIDED INVERTED BUCKET

3 FULL-SIZED DRILLED PASSAGES

4 NO SPLIT GASKET

● No other steam trap has all the advantages of Anderson Super-Silvertop — advantages that mean easier installation, greater accessibility, increased capacity and long, trouble-free service life.

The choice of elbow or straight-in-line connection is realized from the two inlet connections—one at the top, one at the side (a pipe plug closes the unused inlet). This is honest-to-goodness simplified piping. No extra fittings to buy and install, no piping all around the trap, a saving of as much as one hour per trap whether it's elbow or straight through. Besides, since all piping is in the head (see illustration above) trap can be inspected right on the line, without disturbing pipe connections.

Inverted Bucket is guided, controlled to vertical motion only and this permits a larger bucket. Also, since lever arm is fastened beyond the center of the bucket, lever is longer. Larger bucket and longer lever open a larger valve for increased condensate capacity for any given size of trap body.

In Anderson Super-Silvertops, all passages are drilled, not cored—this insures full-sized passages in every trap—smooth passages that are slow to clog and quick to clean. Gasket is a full gasket—no split gasket that might become a source of steam leaks. These facts and guided bucket, together with 54 years of steam trap manufacturing experience, are the reasons for long, trouble-free service life.

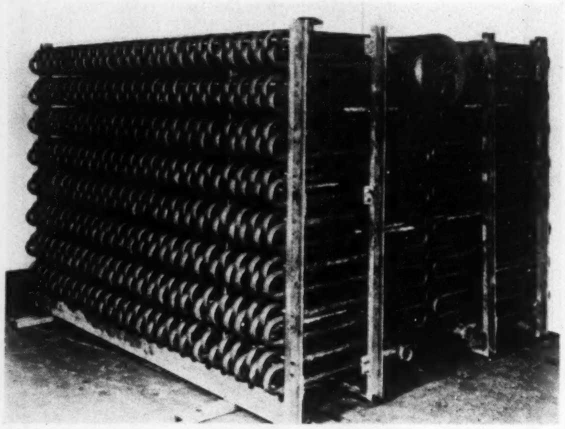
Get all the facts about Super-Silvertop—write today for your free copy of the book—"How To Choose A Steam Trap"—it will help you.

THE V. D. ANDERSON COMPANY
1943 West 96th Street • Cleveland, Ohio

Super-Silvertop STEAM TRAPS

here is an example. Packed into this assembly are 5500 ft of 1 in. full weight black steel pipe, not to mention a 16 in. accumulator, large headers and ample stands; the whole outfit is contained in a space 8 ft, 10 in. long; 7 ft, 1½ in. wide; and but 5 ft, 10⅞ in. high.

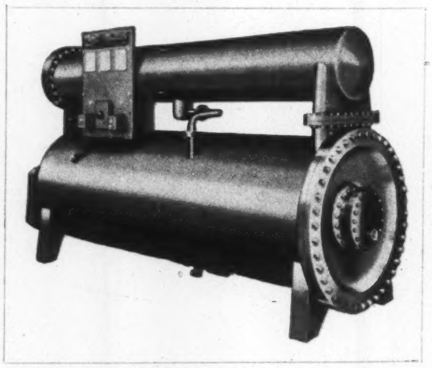
As the coil is used by a dairy for cooling a blast of air, moving lengthwise of the accumulator, it was necessary to arrange the pipes so that there would be no open spaces through which the air could short circuit. Alternate sets of coils were staggered and the bends were set back at the top on each bank to fit the curve of the accumulator shell. While they do not appear in the picture, two large down-pipes, of 3 in. size, connect the accumulator to the liquid headers at the bottom. Eight coils were shortened especially to accommodate these down-pipes.

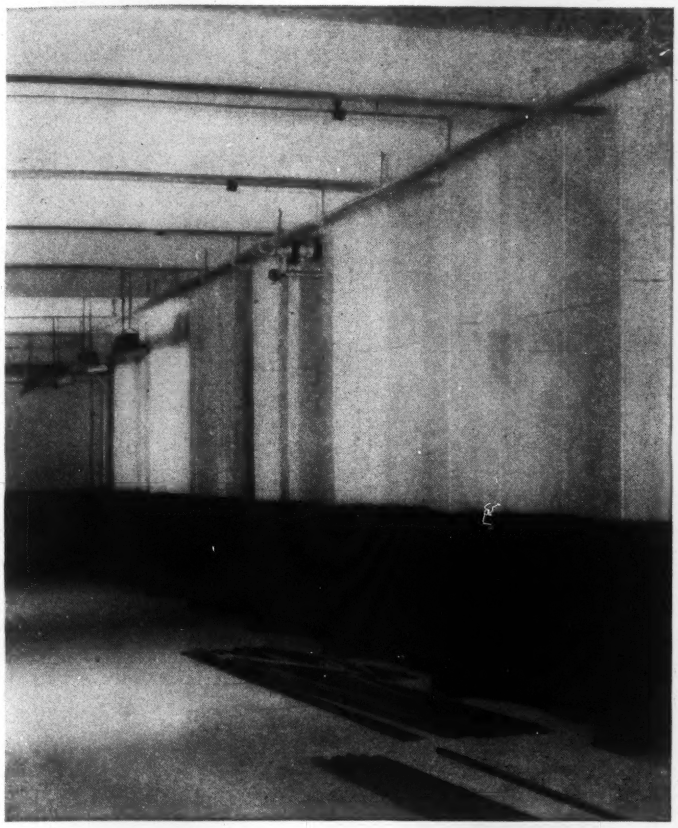


The coil is mounted above a drain pan, and is arranged with spray nozzles for defrosting with city water. Square ducts lead to the housing of galvanized metal surrounding the coil. Three inspection windows are provided in the casing. Both the coil and fan are installed in an insulated room. A float valve controls the ammonia feed to the coil. The suction gas passes through a liquid precooler before reaching the compressor.—Frick Co., Waynesboro, Pa.

Turbo-Vacuum Compressors

No. 2165—The addition of a 50 ton model to its turbo-vacuum compressor line, which already includes 70, 100 and 200 ton sizes, has been announced by the manufacturer. The 50 ton unit is constructed along the same lines as the other sizes and possesses the same inherent characteristics. It is a hermetically sealed, low pressure water chiller constructed with two cylindrical steel shells. A single motor with all impellers on a single shaft is contained within the lower shell with the water chilling coil, while the upper shell houses the condenser coil. All of the necessary parts of this new water chiller are combined in one compact unit.





Mundet insulated all exterior walls in air conditioned areas in new building for Bayuk Cigars, Inc., Philadelphia. Three fermentation rooms were insulated with Mundet Corkboard. Cold lines have Mundet Moulded Cork Pipe Covering. ● Mundet engineering and installation services cover all phases of low-temperature insulation.

CLIMATE *as You Want It*

Tobacco, in its handling, is as temperamental as a debutante. That's why weather has to be made to order for the manufacture of Bayuk cigars. In the modern plant of Bayuk, air conditioning produces the exact atmospheric conditions necessary for fine cigar making. For many years, Mundet Cork Insulation has helped Bayuk to secure precise control of temperature. Mundet Cork Insulation has been specified again for Bayuk's new 5-story addition. ● Mundet Cork Insulation is a dependable barrier to heat infiltration. Through its lasting efficiency the problems of temperature control are simplified; costs are reduced. For helpful data on low-temperature insulation, write today to Mundet Cork Corporation, Insulation Division, 65 S. Eleventh St., Brooklyn, N. Y.

MUNDET
CORK INSULATION

CONSERVES LOW-TEMPERATURE

Fairbanks Valves Chosen For $750,000 Installation

Illustration shows but a few of the Fairbanks Valves on the connections to the chilled water circulating pumps of the air-conditioning system of the Famous-Barr Corp.—the fifth largest department store in the nation. The Eichler Heating Co., St. Louis, had the distinction of installing here the largest air-conditioning system ever put in a retail business in this country.

The reputation of Fairbanks Valves for dependable performance, long service and low upkeep cost is national. If *you* knew more about these valves you, too, would use them.

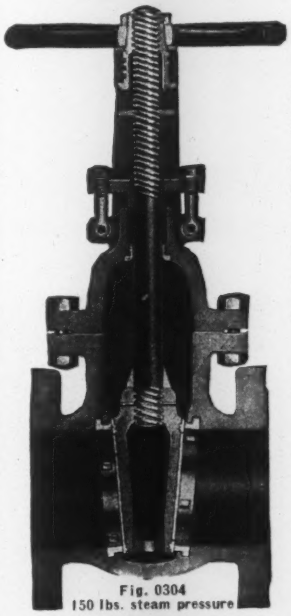


Fig. 0304
150 lbs. steam pressure

Fairbanks Valves are made in bronze and iron for a large range of pressures, in globe, gate, angle, check and cross patterns.

Why not write, while you think of it, for the name of our nearest distributor and catalog No. 21.

THE FAIRBANKS COMPANY
396 Lafayette St., New York, N. Y.
Valves, Dart Unions, Hand Trucks and Wheelbarrows
Boston, Mass., Pittsburgh, Pa.—Distributors in Principal Cities
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks F
Standard and Renewable **Valves**

CAPACITIES

Has double shaking twin grates. Capacity up to 14,600 sq. ft. net load for steam and 23,360 sq. ft. for water.

Hank sez:

Maybe As How He Can Save Money On Your Boiler Replacement Jobs

WHEN it cums ter big heavy duty boilers, tain't no joke ter git 'em in or out. More times than not, it means raising a ruckus tearing out walls, and maybe too floors, to git the old one out.

And that costs money and takes time, both of which is mighty scarce right now.

Knowing sich ter be so, some of you smart engineering fellers has found the answer in this big Burnham twin section 50-inch twin grate, cast iron boiler.

You have let the old boiler a be where it wuz, and put alongside it, one of these Burnhams, what section by section can be slid thru any ordinary sized door or opening that's big enuff fur a man to sneak thru.

We still have a few of these boilers on hand, but no tellin' how long we will. Or if they'll be iron ter be had to make more when they are gone. Which fact may hold a hint or sumpthin fur you.

Hank

Burnham Boiler Corporation

Member of The Institute of Boiler and Radiator Mfrs.

Irvington, N. Y., Dept. P. Zanesville, Ohio, Dept. P.

Branch Offices in All Principal Cities

Export Dept.: 50 Church St., New York City

Burnham Boiler

There are only two moving parts—the motor rotors—in the turbo-vacuum compressors. This factor holds friction to a minimum and insures long and efficient operation for the unit, according to the maker.

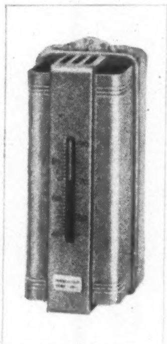
The approximate overall dimensions, in inches, of the new 50 ton unit are: Length—140. Height—73—Width 44. The unit weighs approximately 9300 lb and is shipped completely assembled.—Trane Co., La Crosse, Wis.

Recording Instrument Chart

No. 2166—The new "I-EZ (eye-ease) Permochart," a recording instrument chart for continuous re-use, is made in three colors of "Vinylite" plastic, so colored and shaded as to reduce glare and eyestrain to a minimum, the maker states. The three colors—green, ivory and blue—can be used to advantage in identifying different units or operations, making inspection of charts easier.

Like the white, the colored charts are made for all types of recording instruments using circular charts. No meter changes are required, as these charts are affixed and removed in the same manner as paper charts.—Permochart Co., 461 Chestnut Rd., Sewickley, Pa.

Low Voltage Thermostat

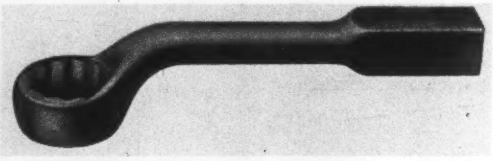


No. 2167—A new low voltage room thermostat for use in controlling low voltage two wire type valves and motors assures accurate control through the use of an artificial heater and a sensitive bimetal actuating element, according to the manufacturer. The differential is adjustable and contacts are of ample capacity for low voltage loads.

Known as the "Acratherm," it has a silver finish and is furnished with a detachable mounting plate to facilitate installation. At no extra cost, it may be equipped with a locking cover to guard against tampering and a positive night cutoff to prevent any operation of the heating plant during the night. Standard range is 54 to 86 F.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

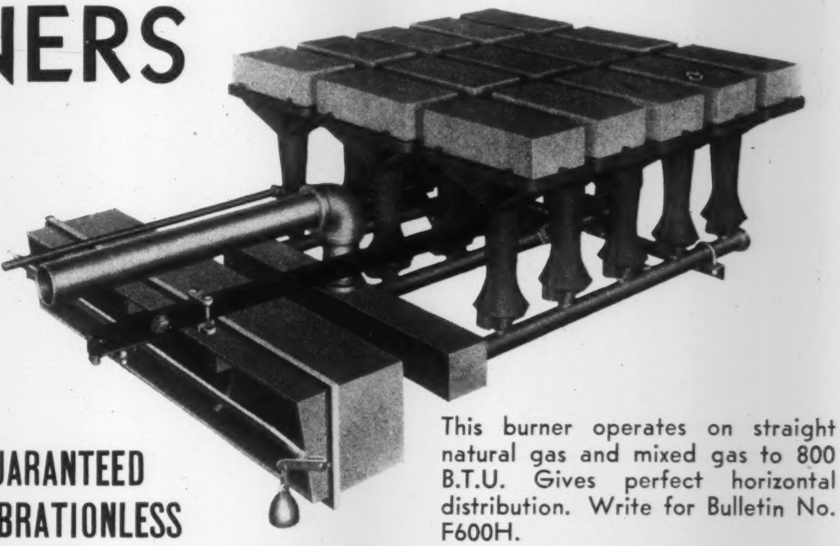
Wrench

No. 2168—The new striking face box "Superwrench" is particularly adapted for heavy work in close quarters where large nuts must be set up tight or frozen nuts loosened, according to the maker. The offset head provides ample nut clearance.



It is available in 10 sizes with 12 point openings, $1\frac{1}{16}$ to $2\frac{3}{4}$ in., for U. S. standard nuts $\frac{5}{8}$ to $1\frac{3}{4}$ in. and is drop forged from chrome molybdenum steel, properly heat treated to withstand shock loads. Finished in baked, gray enamel overall.—J. H. Williams & Co., 225 Lafayette St., New York, N. Y.

WECO-N.G.E. Series F600 GAS BURNERS



These burners are available for ratings from 50,000 to 10,000,000 B. T. U. output, for use in heating boilers, power boilers—in any metal firebox or sectional boiler. Featuring flexibility to meet various firebox shapes and sizes at various gas pressures, and low draft loss. Full automatic controls that operate properly can be easily applied.

GUARANTEED VIBRATIONLESS

This burner operates on straight natural gas and mixed gas to 800 B.T.U. Gives perfect horizontal distribution. Write for Bulletin No. F600H.

THE WEBSTER ENGINEERING CO.
TULSA —DIVISION OF— **OKLAHOMA**
Surface Combustion Corp. . . . . Toledo, Ohio

Wherever QUIET *is essential use . . .*

Careyduct

THE ALL-ASBESTOS INSULATED DUCT

for AIR-CONDITIONING SYSTEMS

CAREYDUCT is made entirely of asbestos — combines both duct and insulation. Simple slip-joint construction and standardized parts make fitting on job easy and rapid. Cuts easily with saw; no shop work necessary.

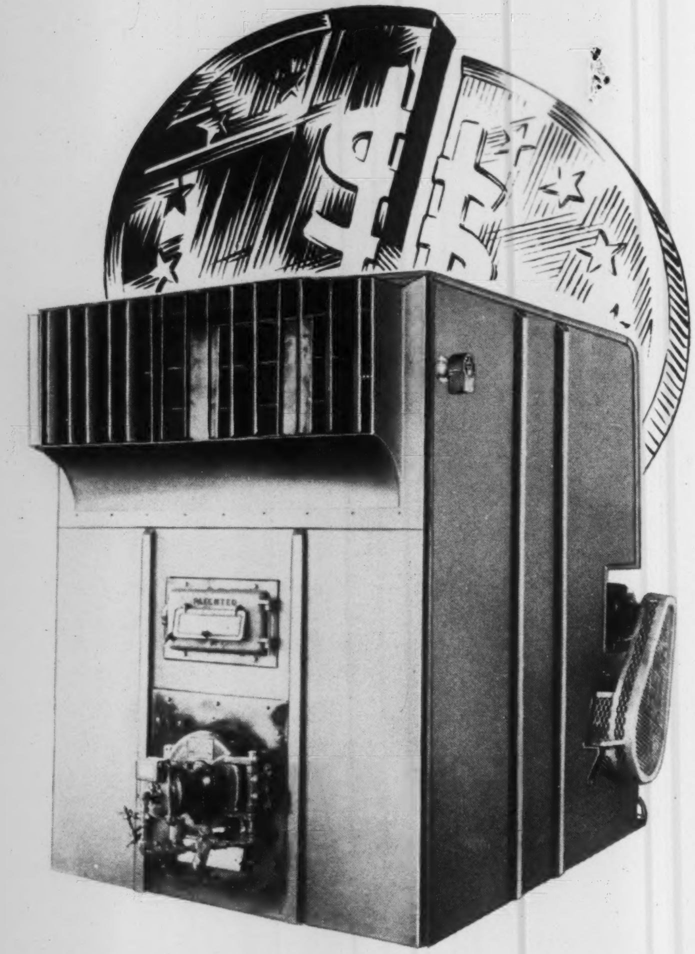
CAREYDUCT "hushes" fan noises; reduces "speaking tube" effects. Air velocities may be increased without noise, enabling you to use smaller sizes—a saving in both materials cost and labor.

CAREYDUCT is fireproof; can't rust or rot. Makes a smoother, better-looking, more efficient job. Size for size, it costs LESS than insulated metal duct.

Bring your duct work up-to-date — keep customers satisfied—make more money—with CAREYDUCT. Write today for full details—address Dept. 25.

Section of Careyduct used in air conditioning system at Crosley Corporation's Stations WLW, WSAI and WLWO, Cincinnati

THE PHILIP CAREY MFG. COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA THE PHILIP CAREY COMPANY LTD. Office and Factory LENNOXVILLE, P. Q.



Half-Price Heat for Your Plant!

THE

DIRECTHERM

HEATER

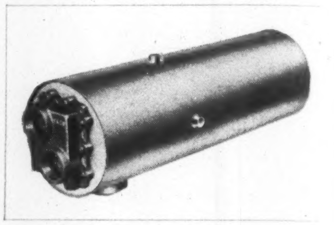
requires no duct (unless desired), no pipes, no radiators, no maintenance. First cost is low, and installation simple. Great fuel savings. 82% of the heating energy is utilized.

We shall be glad to give you exact figures and details. Write for catalog 305A.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

Storage Water Heaters

No. 2169—Illustrated is one of a new line of "HG" horizontal gravity water heaters for use with storage tanks from 700 to 3000 gal capacity. They feature heavy gage steel shells and heavy bronze heads, the maker states; the coil test pressure is 300 psi and the shell test pressure 60 psi.

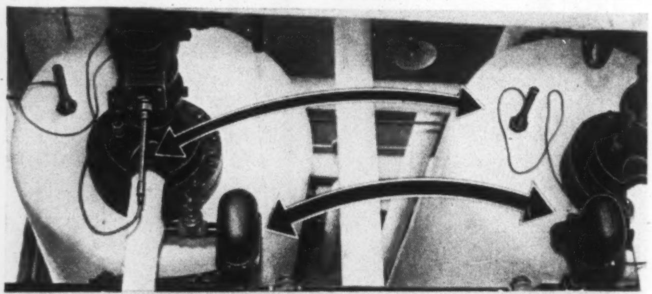


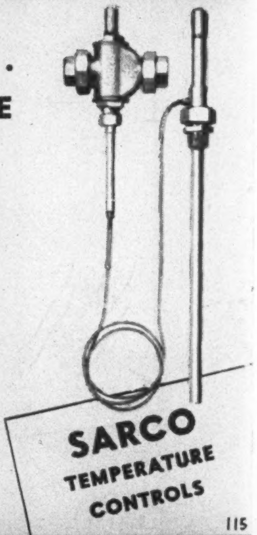
As the shell tappings can be located to meet the particular requirements of any job these heaters have unusual adaptability for meeting tight spots as far as space is concerned, according to the manufacturer.—Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.

Time Switch

No. 2170**—The new "Inter-Matic" time switch has been developed for single cycle operations such as controlling various types of lighting systems and ventilating equipment. The manufacturer has for some years made coin operated time switches and timers for electric ranges.

These switches are for use on alternating current only and are available in the following voltage and cycle combinations: 115 volts, 25 cycles, 35 amperes; 115 volts, 50 cycles, 35 amperes; 115 volts, 60 cycles, 35 amperes; 230 volts, 25 cycles, 35 amperes; 230 volts, 50 cycles, 35 amperes; 230 volts, 60 cycles, 35 amperes.—International Register Co., 15 S. Throop St., Chicago, Ill.





Save WATER...
SAVE HEAT...SAVE TIME

Yes—many times Sarco Control on water heaters saves all three. Water too hot or too cold is often wasted in the plant, and the b.t.u.'s you paid for go down the drain with it.

In process work, incorrect temperatures can produce slow-ups, rejects or even shut-downs.

You can connect up a Sarco Temperature Regulator in a day, save its cost in a few weeks—benfit by it for years. Catalog No. 52.

115

SARCO
SAVES STEAM

SARCO COMPANY, INC.
475 Fifth Avenue, New York, N. Y.
SARCO CANADA LTD., TORONTO, ONT.

Useful Information

Code for Measurement of Water

The Hydraulic Institute, 90 West St., New York, N. Y., has published a Code for the Measurement of Water Using Standard ISA Orifices with Free Discharge, which was prepared by the standards committee of its deep well turbine pump section, assisted by the engineering department of the University of California.

As conditions in the field do not permit an ideal set-up like that in a laboratory, the results are less accurate. Based on experiments, limits of deviation are given for the evaluation of the readings for field conditions. This code was therefore prepared for manufacturers of deep well turbine pumps as a guide for the measurement of capacity in the field in testing deep well turbines when higher precision capacity measuring equipment is not available.

Price of the publication is $1.00 per copy.

Housing for Defense

The real estate profession should take the lead in preventing excessive increases in rents if it wishes to avoid arbitrary rent control laws.

This is one of the suggestions for solving defense housing problems made in a recent survey, Housing for Defense, published by The Twentieth Century Fund,

HYDRON

METALLIC BELLOWS

● We manufacture bellows and bellows assemblies ready for installation in steam traps, relief valves, temperature regulators, pressure regulators, air valves, and other automatic temperature and pressure controls. Complete engineering service.

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PRODUCERS OF BELLOWS EXCLUSIVELY
SERVING AUTOMATIC CONTROL MANUFACTURERS

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"Fabrikated" REG. U.S. PAT. OFF.
Adjustable
DIRECTED AIR FLOW
REGISTERS and GRILLES

LEAD in Adjustability

An unlimited range of deflections is made possible by the ability to adjust the grille bars INDIVIDUALLY. Air flows can be directed up or down, or right or left. The directional adjustment can be made at the time of installing; and after the system is operating, corrections can be made at any time to meet unforeseen or changed conditions.

TWO NEW CATALOGS READY FOR YOU

Independent's two new catalogs just off the press are most complete, with interesting data on registers and grilles for air conditioning installations, and registers and cold air faces for gravity installations. Most conveniently arranged, everything easy to find. Send for your free copies.

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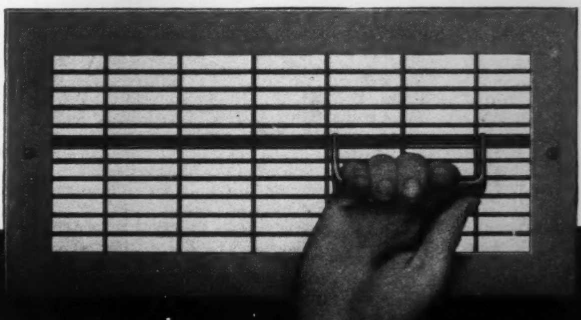

A41

EVERY Grille Bar Can Be INDIVIDUALLY Adjusted

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Reg. U. S. Pat. Off.

INDUSTRIAL OIL BURNING SYSTEMS

FIRE THE BOILERS OF DEFENSE INDUSTRIES

Men responsible for Defense Production MUST select equipment SAFELY.

They MUST obtain:

(1) Reliable operation over definite performance ranges;
(2) Practical, experienced engineering aid;
(3) Positive assurance that parts are instantly available and interchangeable;
(4) Speed in delivery, installation, and "service".

Petro delivers these along with savings in fuel and man power.

Priorities data filed with orders indicate that Petro burners are carrying a notably large share in defense operations, including:

Army Camps, Depots and Buildings; Navy Yards; Shops and Shipbuilding Plants, and a wide range of material producers such as: Powder and Ordnance factories in many states; Air fields and factories; Army Tank makers; Armor plate mills; Machine Tool Factories in every principal industrial locality; Service cloths and blanket mills North and South; Brass, Copper and other metals foundries and mills; and many more.

Contractors serving the general field of business can profitably follow the Defense trend to Petro. Reliability and experienced co-operation are vital in any business, and specifiers and installers of big heating projects can be sure of both good equipment and good service when they select Petro.

Automatic, semi-automatic, or manual operation using No. 5 (or lighter) oil—or No. 6 (Bunker "C") oils, preheated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

Petro burners have been proven by years of steady, satisfactory, operation in thousands of installations, many of which involved unusual or severe operating conditions. Actual operating data on specific applications is available to correspond closely to almost any firing job a contractor cares to describe. Petro's Engineering Division will gladly offer suggestions, submit specifications and, in general, co-operate closely with the trade.

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Established Contractors!! Write for Petro Industrial Equipment Catalog. A valuable reference book for contractors.

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

330 W. 42nd St., New York, N. Y. The Fund, which was established in 1919 by the late Edward A. Filene and endowed by him, is a foundation for research in current economic problems.

Among the points of real estate policy recommended in the report for communities faced with the problem of providing housing for workers in defense industries are the following: more intensive use of existing lots, existing housing and public service facilities before development of new districts or communities; campaigns for repair and conversion of older properties; systems of voluntary rent controls; revision of zoning laws where necessary; and simplified procedure for foreclosing tax liens and clearing tax titles.

Book Reviews

Heat in Theory and Practice

[Heat in Theory and Practice Essential to Refrigeration and Air Conditioning, by Samuel Richard Cook. 1st ed. 1941. 232 pp., 6x9 in., clothbound. Published by Nickerson & Collins Co., 435 N. Waller Ave., Chicago, Ill.. Price, $2.00.]

This volume is not intended as a treatise on the subject of heat or refrigeration and air conditioning, but is rather a supplementary volume designed to aid the student in obtaining a clear concept of the fundamental changes and processes involved. Information for the solution of problems arising in refrigeration and air conditioning work is presented and the author has endeavored to coördinate energy, work, heat and electricity.

I'M THE BEST APPRENTICE A MASTER PLUMBER EVER HAD . . .
KEY-TITE
WATER PROOF
PIPE JOINT
COMPOUND
Let Key-Tite, The Leak-Proof Sealing Compound Help You Speed Up Your Work and Save You Money.

With skilled mechanics becoming more scarce, you need Key-Tite to "give you a lift". Take a can of it with you on every job where you are hooking up water, gas, low-pressure steam lines, compressed air, etc.

Joints sealed with Key-Tite are easy to open without damage to threads or fittings . . . alterations can be made speedily and economically at any time in the future. It's economical to use because it goes several times as far as ordinary pipe dopes. Key-Tite contains no lead nor lead substitutes and will *not* affect the color, taste, or odor of potable liquids. It will not harden or settle in the can, but retains its plastic qualities and full-body at all times.

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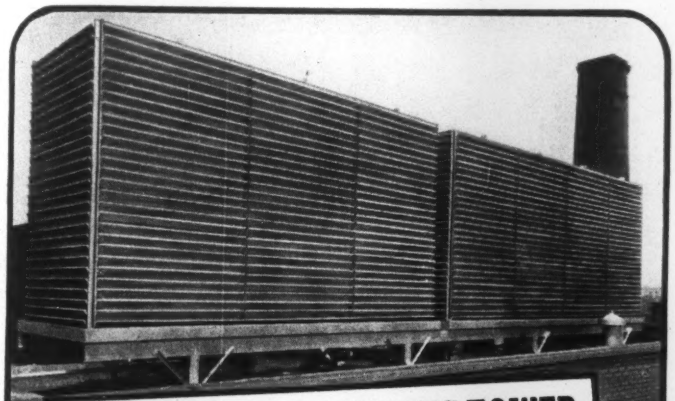
There are chapters on the following subjects (in addition to two chapters devoted to definitions, tables and charts, and an appendix presenting a note on a radiant energy theory of radiant heat): historical sketch; general survey; essential nature of heat; some essential properties of heat; heat and work; relation of heat energy to mechanical and electrical energy; reaction of material bodies to heat energy; heat transfer; temperature; the nature of vapor; the function of vapors in refrigeration and air conditioning; heat principles in refrigeration and air conditioning; principles of refrigeration; refrigerants; problems arising in refrigeration and air conditioning; insulation; refrigeration and air conditioning machinery; and terms fundamental to refrigeration and air conditioning.

Petroleum Handbook

[The Waverly Handbook, compiled and edited by S. G. Symons. 10th ed. 1941. 902 pp., 4x6½ in., flexible cover. Published by the Symons Co., 1501 Investment Bldg., Pittsburgh, Pa. Price, $2.00.]

Sponsored by the Waverly Oil Works Co., this book has been written and compiled by leading petroleum engineers and authorities and contains information pertaining to practically every phase of the petroleum industry. It should be of value to oil men, engineers, chemists, and to engineering and petroleum students.

There are 18 chapters, and among them are included discussions of refining processes, the uses and advantages of fuel oil, ASTM petroleum standards, fire underwriters regulations, and various formulas, tables and other engineering data.



THERE'S A BINKS COOLING TOWER FOR EVERY WATER-COOLING JOB

Whether your problem is cooling the water for a small air conditioning unit or a large installation serving a complete building, BINKS has just the right cooling tower. Each is custom built to meet your specific needs. There is no waste. The use of BINKS famous spray nozzles in these towers further increases their efficiency. All types of towers are available—atmospheric, induced and forced draft.

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SAVE HOURS IN ASSEMBLY

In times like these when man-hours are at a premium and high working speed is all-essential to national emergency, W-S Socket Welding Fittings are vitally important.

In close quarters, tedious, complicated piping layouts can be easily installed with great speed and accuracy when W-S Socket Welding Fittings are used.

Besides saving hours of time, trouble and money in assembly, W-S Socket Welding Fittings bring assurance of long periods of trouble-free service.

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SOCKET WELDING FITTINGS
W-S Socket Welding Fittings, exceptionally strong and durable, have deeper sockets with smooth, correctly proportioned walls conforming to tentative A.S.A. standards.

SCREW END FITTINGS
W-S Screw End Fittings have longer bands extending well beyond the last thread—providing added strength and durability.

Both types of W-S Forged Steel Fittings are available in carbon steel and alloy steels. Send for bulletin A-3; it gives all the facts—pressure ratings, sizes and prices. Write today.

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The Enduring Metal—

FOR ALL AIR CONDITIONING JOBS

HUSSEY

PURE LAKE COPPER

Thousands of years ago Indians found solid deposits of pure copper in the Great Lakes regions and beat it into many useful forms. Since unearthed, these ancient forms reveal the remarkable immunity of Nature's own copper to corrosion. Because Hussey Pure Lake Copper comes from the same pure Great Lake deposits, the working and corrosion-resisting qualities of Hussey are unique—one of the big reasons why Hussey Copper is so widely preferred in the air conditioning industry.

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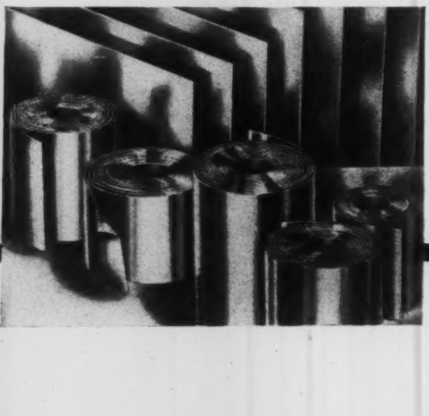

Coming Events

National Industrial Advertisers Association: Annual conference, September 17-19, Royal York Hotel, Toronto, Canada. Headquarters office, 100 E. Ohio St., Chicago, Ill. Program includes talk by Willard V. Merrihue, General Electric Co., on the planning, execution and results of a promotion campaign for motors; clinic on motion pictures and other visual aids to selling, conducted by Walter A. Bowe, Carrier Corp.; clinic on how to get material for advertising, conducted by V. H. Van Diver, Union Carbide Co.; clinic on industrial photography, led by Edward W. Falcon, Warner & Swasey; direct mail clinic, by Samuel E. Gold, Lignum Vitae Products Corp.; talk on advertising analysis, by Richard Manville, Newell-Emmett Co.; an address on industrial advertising in a wartime economy, by Horace T. Hunter, MacLean Publishing Co., Ltd.; clinic on successful operation of an NIAA chapter; symposium of current advertising, led by H. H. Simmons, Crane Co.; marketing clinic, conducted by R. O. Eastman, Eastman Research Organization; discussion of selling in Canada, by I. D. Carson, Canadian National Newspapers and Periodicals Association; address "Are Industrial Buyers People?", by Forrest U. Webster, MacManus, John & Adams, Inc.; and others.

National Safety Council: Safety congress and exposition, October 6-10, Stevens Hotel, Chicago, Ill. Theme of the congress is to be "Help Defense—Stop Accidents."

YOU WILL FIND PECORA CALKING COMPOUND CHEAPEST IN THE END

Temperature control in air conditioning is materially aided when calking is provided around all window and door frames, and when all building and air duct joints are sealed.

The preferred calking compound is PECORA. It is impervious to heat, cold and moisture. Properly applied, it will not dry out, crack or chip. Made of finest ingredients to special formula. Unvarying in quality and performance.

Available in bulk, also in non-refillable metal cartridges for the Pecora High Pressure Calking Gun illustrated.

This Gun With 3 Nozzles and 4 Cartridges of approx. 1 qt. each
Shipped Express Collect for **$7.00**
Terms: 2% disc. net cash with order. To approved credits 2% 10 days, 30 days net. F. O. B. Philadelphia, Pa.

Write for Folder and Prices

PECORA PAINT COMPANY, Inc.
Established 1862 by Smith Bowen
Fourth St. & Penna. R. R. Philadelphia, Pa.
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You can always get what the job calls for in the **WeldELL** *line!*

6" STD. TAYLOR FORGE WELDELL (PAT. 1935805)

The widest selection of types – sizes – thicknesses

ONE of the major advantages in using Taylor Forge WeldELLS and other Taylor Forge Welding Fittings is that in this one broad line is included practically every type, size, thickness and material that is ever required on any pipe welding job.

Naturally not all of the many types of Taylor Forge Welding Fittings are as widely used as WeldELLS. There are bound to be some "slow movers" in such a big line, and the small demand for such fittings, with no corresponding reduction in tooling and other production costs, sometimes makes them unprofitable to us.

But we couldn't follow our basic business principle of providing *maximum utility, convenience and economy,* and be satisfied with a "short line" The needs of our customers are too important to us. That's why you'll find Taylor Forge making a more complete line of Welding Fittings than any other manufacturer.

Just another example of the extra value Taylor Forge provides at no extra cost to the user . . . for WeldELLS and other Taylor Forge Fittings for Pipe Welding cost no more than other makes.

• To learn just how complete the Taylor Forge line really is get Catalog 401. There's a lot of other useful information in this book, too. Write for your copy today.

TAYLOR FORGE & PIPE WORKS, General Offices & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

OTHER EXTRA VALUE FEATURES

In addition to the features described opposite, WeldELLS have the following advantages which are combined in no other welding fitting:

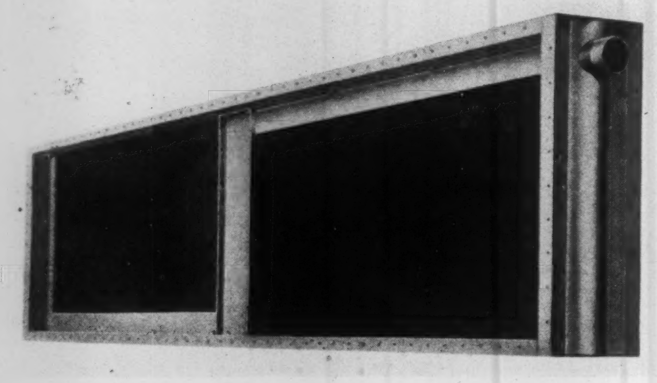
1. **Seamless**—greater strength and uniformity.
2. **Tangents**—keep weld away from zone of highest stress—simplify lining up.
3. **Precision quarter-marked ends**—simplify layout and help insure accuracy.
4. **Permanent and complete identification marking***—saves time and eliminates errors in shop and field.
5. **Selective reinforcement**—provides uniform strength.
6. **Wall Thickness never less than specification minimum**—assures full strength and long life.
7. **Machine tool beveled ends**—provides best welding surface and accurate bevel and land.

*Since the marking is pressed into the metal before forming, and since the manufacture of the fittings is carried out at a forging temperature, each in effect receives a heat treatment after the operation. The indentations have no sharp corners or edges and the marking has no effect on the strength of the fitting.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Extra Length Heating Surface



No. 2171—Extra-length surface with steam distributing tubes known as "Duplex Surface," has been introduced. The problem of distribution was solved by combining two heating elements in a single casing provided with separate steam and return headers, yet so interconnected that only one main steam connection and one main return connection are required.

According to the manufacturers, the widespread success that had attended the application of steam distributing tube surface in medium-sized air handling systems created a demand for the same quality of performance in longer sections better adapted to large installations. Experience showed that it would often be very desirable in large systems for reasons of space to employ sections of almost twice the customary length. With the duplex sections it is claimed that requirements for long surface may now be met with complete assurance that the installation will produce the same desirable results of uniform temperatures, high capacity, and resistance to freezing.

The new surface is available in extended fin lengths from 80 to 128 in.—John J. Nesbitt, Inc., State Rd. & Rhawn St., Philadelphia, Pa.

FOR YOUR CONVENIENCE

Heating, Piping and Air Conditioning, [10-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2171 2172 2173 2174 2175 2176 2177 2178 2179 2180
2181
3993 3994 3995 3996 3997 3998 3999 4000 4001 4002
4003 4004 4005 4006 4007 4008 4009 4010 4011 4012
4013 4014 4015 4016 4017 4018 4019

Name.............................. Title...................

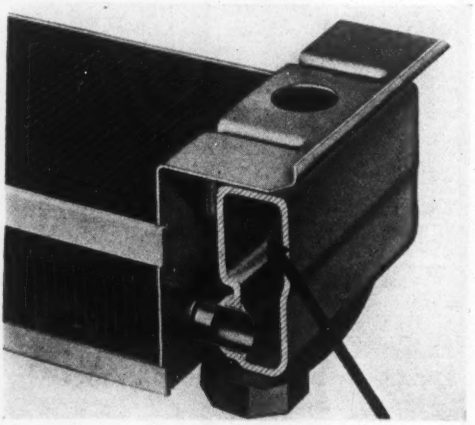
Company ....

Address ....

City.............................. State...................

Convectors

No. 2172—Developments in the design of enclosures and heating units for a line of convectors which includes four different types were announced last month. The types include the "Hiflo," for one pipe and gravity hot water; the "Turboflo," for two pipe forced hot water; the "Standard," for vapor and vacuum steam; and the "Quiet-Seal," for one pipe steam.



Developments announced by the manufacturer include a built-in air chamber (illustrated) on the hot water heating unit to eliminate the need for accessory air storage equipment. Another feature is that enclosures have built-in heating unit supports that permit manual pitching of units at several different elevations and degrees of pitch. The heating units can be installed or removed from enclosures without the use of tools.

In order to simplify installation, the heating units are shipped to the job in their enclosures. Recessed enclosures are designed to permit the setting in on the job of fiber board insulation between sheathing and enclosure back.—Modine Mfg. Co., 1772 Racine St., Racine, Wis.

Here's the way to Laugh at Air Filter Troubles

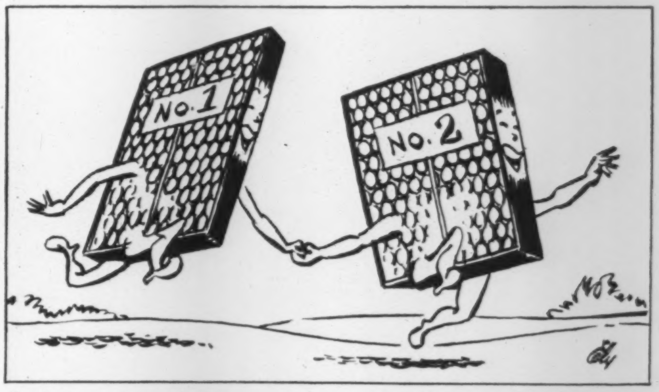
1. Fiberglas* Dust-Stop* Air Filters lift company treasurers to seventh heaven. They're so darn inexpensive! They cost only about 1¢ per CFM to install . . . complete! And one-tenth of a cent per CFM replaces the filters when they have to be changed. That's the first advantage . . . economy!

2. There's no need to lose your hair worrying over how much changing filters will cost you. Dust-Stops don't require expensive, special handling. Or any charging, washing, draining, etc. You won't have to bother with spares or skilled labor! That's the second big point—Dust-Stops give you *no* trouble on maintenance!

3. You'll be the toast of the company for years if you use Dust-Stops! They are so efficient . . . stopping practically all "nuisance" dusts! Capacity: 2 CFM per square inch of area at 300 FPM. Average resistance, new (in inches of water gauge): .062 for 1-inch; .13 for 2-inch Dust-Stops. That's the third plus . . . efficiency!

4. Dust-Stops give combustion the cold shoulder, too! The glass fiber filtering element will *not* support combustion. What a comfort that is! And that's the fourth fact to remember! What's more . . .

5. The strongest telescope can't detect any signs of bleeding from Dust-Stops! So don't give adhesive droplets on inside ducts or walls a second thought. That's the fifth thing you're looking for! Add all these grand features together and . . .



6. Order replaceable Dust-Stops . . . today! Get the five pluses you want in air filters! Order Dust-Stops from your air-conditioning manufacturer, dealer, or jobber. Or write us! They come in two thicknesses, No. 1 (1-inch) and No. 2 (2-inch). *Owens-Corning Fiberglas Corporation, Toledo, Ohio.*

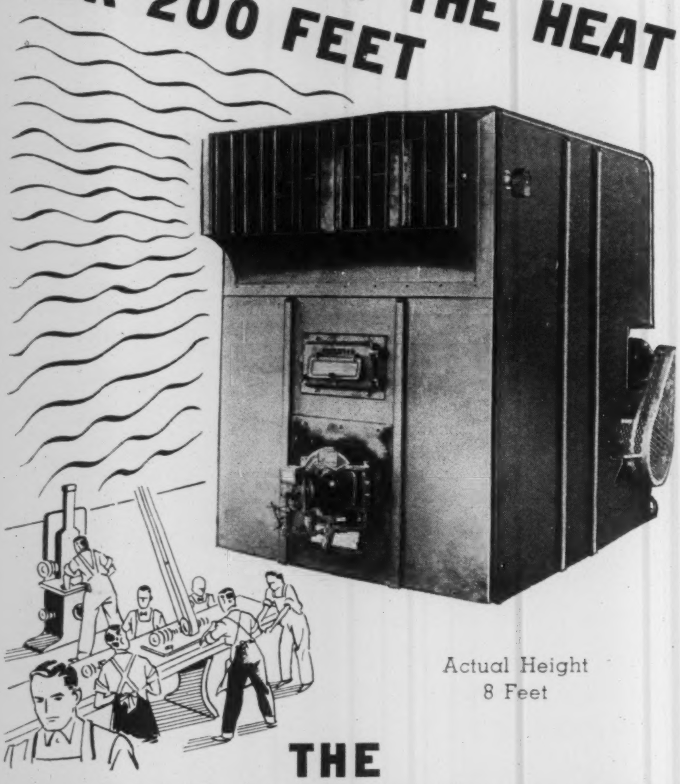
FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U. S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

DIRECT CANADIAN INQUIRIES TO FIBERGLAS CANADA LIMITED, OSHAWA, ONTARIO

THROWS OUT THE HEAT FOR 200 FEET



THE
DIRECTHERM
HEATER

distributes the heat through its forceful draftless fan system as far as 200 feet away. The entire area is equally warm—whether you stand right in front of the heater or in the farthest corner.

More than that: the Directherm can be easilly installed with low cost, requires no duct work, and utilizes about 80 per cent of the fuel energy. This is economical heat.

Write for bulletin 305 Z. It gives detailed information about Directherm—the direct-fired Unit Heater in 6 sizes (300,000 — 1,700,000 B.T.U.) for oil, gas or coal.

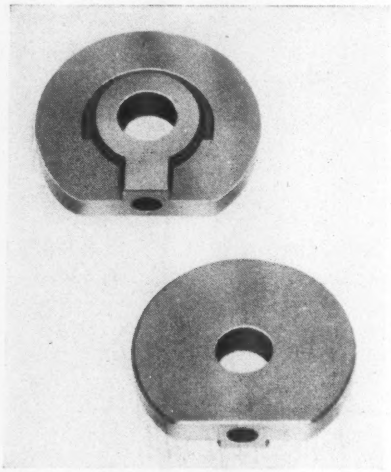
●

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

Bronze Bearings

No. 2173—Several new shapes and sizes for the line of "Selflube" porous bronze bearings have been developed. The illustration shows top and bottom views of one of the new designs.

These bearings are made from powdered alloys, which are molded to size in the shape desired, then baked, and finally quenched in oil. They have an average porosity of 35 per cent, enabling them to store a large amount of oil which forms a protective, continuous oil film on the bearing surface, the maker states. In many instances, this oil reserve lasts the entire life of the application, eliminating the use of oil vents or grease cups. Additional lubrication is recommended for heavy duty or continuous operating units.—Keystone Carbon Co., 1935 State St., Saint Marys, Pa.



Molded Plastic Fan Blades

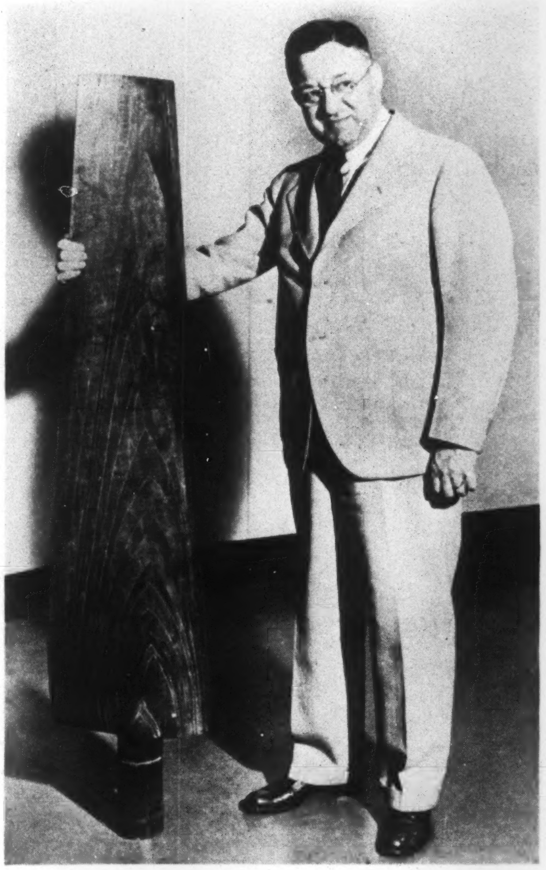
No. 2174—The longest mold ever made by the plastics department of the General Electric Co. is being used at West Lynn, Mass., to produce fan blades formerly made of metals. The fan blades, 4½ ft long, are made for the Foster Wheeler Corp. for cooling tower fans. A molded plastic fan blade is particularly important at this time because of the need of metals formerly used, such as aluminum and magnesium, for defense, according to the announcement.

The fans are used in large cooling towers required for cooling water for power plants, condensing oil refineries, air conditioning and similar applications. For efficient and economic operation, a light fan blade is important. The new plastic blade is lighter than the metal blades it replaces, but is of about equal strength.

Corrosion was the chief trouble in the use of metal blades. This problem was particularly acute in many localities where contact with even a small amount of salt water caused corrosion. To offset this, the metal blades had to be painted and baked. The plastic fan eliminates this difficulty.

Another advantage, which is expected to result in an increase in efficiency, is that the plastic blades have the theoretically exact surface which is smooth, due to the fact that they are made from a mold.

Foster Wheeler officials pointed out that on one recent application in an important defense project before the development of the plastic blade, corrosion difficulties

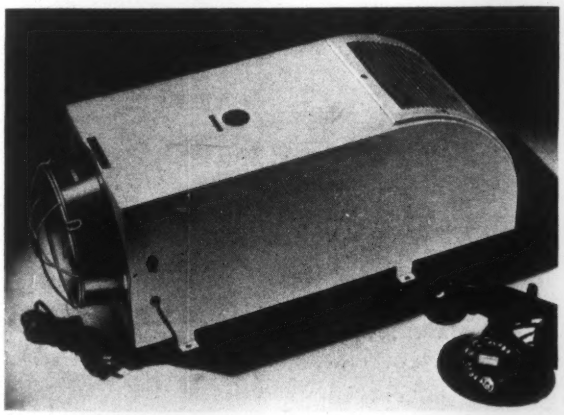


were anticipated and led to the decision of using a stainless steel blade, adding very greatly to the cost and total weight of the fans.

The fan blades are made of a molded laminated "Textolite." They weigh approximately 25 lb each. Four blades are assembled on a molycast iron hub to make a fan of 12 ft diameter.

Odor Adsorber

No. 2175—The new "Type A" odor adsorber will rid 100 cfm of air of odors and gases, and is especially designed for doctors' offices, small shops, homes, reception and dressing rooms, etc., the manufacturer says. This "Dorex" odor adsorbing equipment, which is extensively used in industrial plants, hospitals, laboratories, municipal plants and other sites where odors are a problem, utilizes the adsorption principle of specially processed, highly activated coconut shell carbon.



Asbestos Protected

DUX-SULATION

for SOUND ABSORBING AND INSULATING, HEATING, VENTILATING AND AIR CONDITIONING DUCTS

for **IMMEDIATE DELIVERY**

DUX-SULATION is now available for immediate delivery . . . 1 roll or 1000. It comes complete. . . . Everything necessary (adhesive and binding tape) for its simple application is included in each shipment. . . . Nothing else to buy. . . . No lugs, screws, bolts, or wire. . . . Dux-Sulation's flexibility makes it ideal for round or rectangular ducts, and it cuts without waste.

Has These Superior Features

DUX-SULATION has a 75% insulating efficiency (K factor .27 B.T.U.). . . . High sound absorbing efficiency (70%). . . . Low frictional resistance. . . . Prevents condensation. . . . Will not rot, chip or flake. . . . Easiest insulation to apply and looks best. . . . Dux-Sulation is easy to handle in stock or on the job. . . . Each roll contains 100 Sq. Ft. of standard 1/2" thickness. Time tested jobs in United States and foreign countries prove that Dux-Sulation is the superior Duct Insulating Material.

Specify ASBESTOS PROTECTED DUX-SULATION on all your duct work. . . . A Dux-Sulation insulated job gives higher unit-performance at much lower cost.

Send for Bulletin 406 at Once

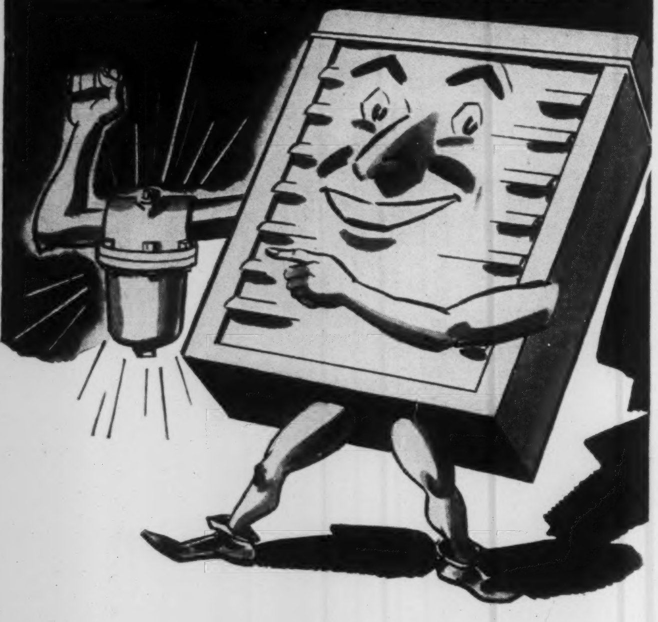
GRANT WILSON, INC.
4101 West Taylor Street CHICAGO

PLANT RUBBER & ASBESTOS WORKS
537 Brannan Street SAN FRANCISCO

AIR CONDITIONING UTILITIES CO.
8 West 40th Street NEW YORK

ATLAS ASBESTOS CO., LTD.
110 McGill St. MONTREAL, CANADA

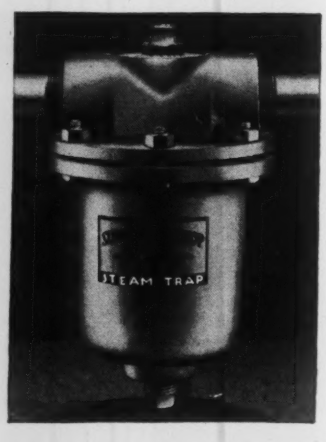
PUT NEW ZIP IN YOUR
OLD UNIT HEATERS



● Maybe you *should* have new unit heaters—but can't get delivery. Maybe you *have* to make the best of present equipment that just doesn't produce. That's when you want more zip in those old unit heaters. You can get it!—by replacing inefficient steam traps with modern, steam saving, Anderson Super-Silvertop traps.

In a careful test, Super-Silvertops increased heater output 25% over the output using a good quality thermostatic trap. Super-Silvertop operates on the presence of water or air—not the temperature. There's no time lag waiting for air or water to cool off.

If you need more zip in your present unit heater—or full rated capacity from new heaters—use Anderson Super-Silvertop inverted bucket steam traps. Write for book—"How To Choose a Steam Trap."



THE V. D. ANDERSON COMPANY
1949 West 96th Street • Cleveland, Ohio

Super-Silvertop STEAM TRAPS

The unit comes in an attractive, streamlined enameled metal case with chromium trim, and can be used either as a portable or stationary model. It is 24 in. long, 10 in. high and 10 in. wide, with a 40 watt motor, circulating fan, a dust filter, and four carbon filled canisters. In operation, the foul air in a room or enclosure is drawn into the adsorber where it passes through the bed of activated carbon. The countless canals and capillaries in the carbon remove the entrained odors and gases.—W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y.

Electric Unit Heaters

No. 2176—The new, improved "HF" blower type heater is rated 1500 to 4000 watts, for operation on 115 or 230 volts, 60 cycle, a-c, and 115 or 230 volts, d-c. "Chromalox Koilstrip" heating elements are used in conjunction with a quiet cadmium plated fan, driven by an enclosed type electric motor, providing an air temperature rise of 32 to 75 F, at an air velocity of 130 to 180 fpm, depending upon rating, according to the maker.

It is designed for portable or permanent wall mounting, and has adjustable louvers and a gray crinkle lacquer finish.

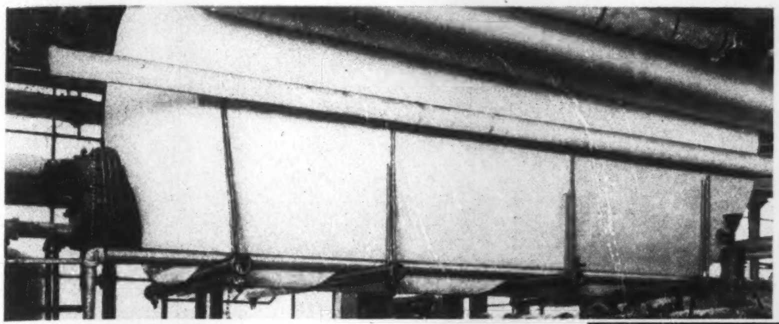
The new "Type C" convection heater is rated 1500 to 3000 watts, for operation on 115 or 230 volts, 60 cycle, a-c, and 115 or 230 volts, d-c. Curved baffles efficiently discharge warm air generated by "Chromalox Finstrip" heaters.

These units are furnished with two toggle switches, each controlling one-half the wattage, so that heaters may be operated at either half or full heat. Finished in bronze crinkle lacquer and floor mounting brackets.—Edwin L. Wiegand Co., 7610 Thomas Blvd., Pittsburgh, Pa.

Filtering Liquids and Gases

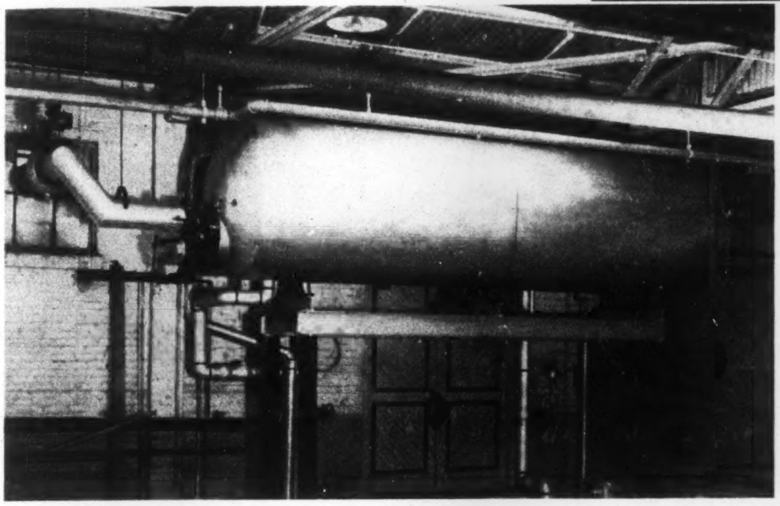
No. 2177**—Representing what is described as a new technology in control of filtration and flow of liquids and gases, a porous metal product known as "Porex" has been introduced. It has two principal functions, which are to remove foreign materials from fluid, such as oil, and to alter the characteristics of gases by diffusion, reducing pressures and controlling flow rates. The product is manufactured from powdered metal subjected to a series of processing operations.

Applications are found in almost any appliance or



Whitlock Everdur Heater, Emerson Laundry
Elizabeth, N. J.

Whitlock Everdur Heater, Lenox Laundry
Mt. Vernon, N. Y.



Hundreds of Building Owners give credit for their satisfactory hot water supply to

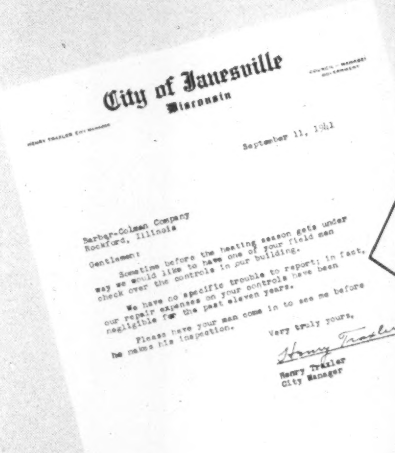
WHITLOCK

Whitlock defines a satisfactory hot water supply as one which provides all the CLEAN, HOT water required—with the least possible drain on the fuel supply!

Hotels, laundries, offices, clubs, schools and colleges, hospitals, and industrial plants the country over depend upon Whitlock Storage Heaters—and have for years!

Bulletin 40 describes these Type K Heaters, address:

THE WHITLOCK MANUFACTURING CO.
44 South Street, Elmwood, Hartford, Conn.
District Offices in New York, Boston, Chicago,
Philadelphia, Detroit, Richmond



City of Janesville
Wisconsin

September 11, 1941

Barber-Colman Company
Rockford, Illinois

Gentlemen:

Sometime before the heating season gets under way we would like to have one of your field men check over the controls in our building.

We have no specific trouble to report; in fact, our repair expenses on your controls have been negligible for the past eleven years.

Please have your man come in to see me before he makes his inspection.

Very truly yours,

Henry Traxler

Henry Traxler
City Manager

HT:vk

WHAT WE MEAN BY "MINIMUM MAINTENANCE"...

repair expenses on your controls have been negligible for the past eleven years.

The Janesville City Hall, Janesville, Wisconsin, is a fair sample of how Barber-Colman Electric Controls require little, if any, upkeep expense. This building has individual room control — a fairly elaborate installation — yet, as Mr. Traxler's letter states, the outlay for repairs has been "negligible" in the eleven years since the system was put in. Barber-Colman Electric Controls are designed and built to give a lifetime of accurate and reliable service with MINIMUM MAINTENANCE cost. This is an important factor that deserves thorough consideration when purchasing a control system.

SPECIFY!

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ELECTRIC CONTROLS BY BARBER-COLMAN

1228 ROCK ST. **BARBER-COLMAN COMPANY** ROCKFORD, ILL.

PETRO
Reg. U. S. Pat. Off.

INDUSTRIAL OIL BURNING SYSTEMS

FIRE THE BOILERS OF DEFENSE INDUSTRIES

Men responsible for Defense Production MUST select equipment SAFELY.

They MUST obtain:

(1) **Reliable operation over definite performance ranges;**
(2) **Practical, experienced engineering aid;**
(3) **Positive assurance that parts are instantly available and interchangeable;**
(4) **Speed in delivery, installation, and "service".**

Petro delivers these along with savings in fuel and man power.

Priorities data filed with orders indicate that Petro burners are carrying a notably large share in defense operations, including:

Army Camps, Depots and Buildings; Navy Yards; Shops and Shipbuilding Plants, and a wide range of material producers such as: Powder and Ordnance factories in many states; Air fields and factories; Army Tank makers; Armor plate mills; Machine Tool Factories in every principal industrial locality; Service cloths and blanket mills North and South; Brass, Copper and other metals foundries and mills; and many more.

Contractors serving the general field of business can profitably follow the Defense trend to Petro. Reliability and experienced co-operation are vital in any business, and specifiers and installers of big heating projects can be sure of both good equipment and good service when they select Petro.

Automatic, semi-automatic, or manual operation using No. 5 (or lighter) oil—or No. 6 (Bunker "C") oils, preheated. Capacities to 145 gallons per hour. 487 boiler H. P.—68,000 sq. ft. steam.

Petro burners have been proven by years of steady, satisfactory, operation in thousands of installations, many of which involved unusual or severe operating conditions. Actual operating data on specific applications is available to correspond closely to almost any firing job a contractor cares to describe. Petro's Engineering Division will gladly offer suggestions, submit specifications and, in general, co-operate closely with the trade.

FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S

Established Contractors!! Write for Petro Industrial Equipment Catalog. A valuable reference book for contractors.

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT

piece of industrial equipment involving the flow of gases or liquids, according to the maker. These uses are found in pumps, refrigerators, fuel lines, lubricating systems, oil burners, evaporators, absorbers, paint sprayers, premixed gas burners and other devices.

Standard shapes now available are discs, sheets, cylinders and truncated cones, while special shapes also are obtainable. One important and unique feature of the material is its ability to be bonded to steel and copper. In this way, it can be made an integral part of solid metal which may be machined, ground, bored, threaded or processed for individual requirements.—General Motors Corp., Moraine Products Div., Dayton, Ohio.

Temperature Control

No. 2178—A 5 in. diameter circular with an ingenious revolving dial which acts as a heat requirement calculator has been made available. By simply setting the dial to any outside temperature it shows the corresponding degree days, the proper time at that particular temperature to start heating, the proper proportion of time heating is required, and the correct time to shut off heating at night.

It also shows the excess capacity of the plant, and therefore the potential fuel waste at given temperatures. The calculator is particularly useful in graphically showing the heat requirements of a building at various outside temperatures.—Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.

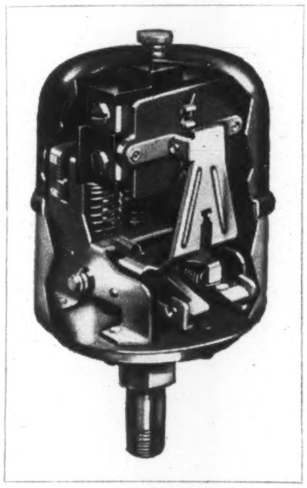
Seamless Metal Hose

No. 2179—A newly developed construction of seamless metal hose distinguishes itself by its double thread, helical corrugations. The double thread corrugations insure better distribution of stress and result therefore in greater durability and safety as well, says the manufacturer.

The unit shown represents an anti-vibration tube of 6 in. ID; the outside diameter measures 7¾ in. and the overall length is 30 in. A rigid brass companion flange is brazed on one end and the other end is provided with a floating flange for proper adjustment to existing equipment. The tubing is made of bronze, suitable for conveying water, steam, gas, oil, etc. Any length and any type of end connection can be furnished, it is stated. For high pressures the tubing is reinforced by means of metal braids and armor.

As a matter of comparison a coil of the manufacturer's smallest size of seamless flexible tubing is shown; it measures $\frac{1}{16}$ in. ID and $\frac{3}{16}$ in. OD.—Seamlex Co., Inc., 5-18 48th Ave., Long Island City, N. Y.

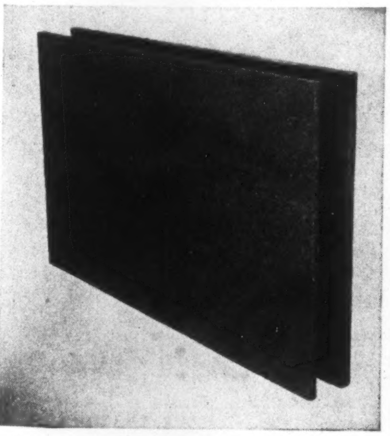
Pump Control Switch



No. 2180—A newly designed electric pump control—an automatic pressure switch—is designed to control the pressure in water systems where an electric pump is used to maintain a given pressure. Settings may be obtained so as to start or stop the motor at any desired pressure within the limits of the control.

It can be supplied either with or without a short pipe nipple for tapped hole mounting, will fit a ¼ in. standard pipe thread, and can be mounted in a turning radius of 1¾ in. The range pressures can be adjusted from 10 to 25 psi closing pressure and from 30 to 45 psi opening pressure. The switch will operate single or polyphase a-c motors up to 2 hp on 110 volts or 3 hp on 220 volts and a ½ hp or less on 32, 110 or 220 volts d-c.—Sampsel Time Control, Inc., Spring Valley, Ill.

Low Temperature Insulation



No. 2181—A new insulating block with mineral base for low temperature work known as "Koldboard," is highly moisture repellent, according to the maker. Laboratory reports show that its moisture absorption is 0.68 per cent at a relative humidity of 65 per cent and a temperature of 75 F.

It is made in block form—36 in. long, 12 in., 18 in. and 24 in. wide, and from ½ to 2 in. thick. It can be cleanly cut to fit irregular planes or odd corners, if necessary. — Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J.

Engineers Recommen
ANEMOSTATS
For Leading Installations
To Assure the Ultimate In
DRAFTLESS
AIR DIFFUSION

Engineers throughout the industrial world realize the extreme importance of faultless air distribution.

This accounts for the wide usage of ANEMOSTATS, Draftless Air Diffusers, in foremost factories, offices, theatres, stores, etc.

Faultless Air Distribution means draftless distribution of the heated, cooled or ventilation air, the equalization of temperature and humidity and the prevention of stale air pockets in which the air is either too hot and too dry, or too cold and too humid.

If you have faulty air distribution, the *objectionable conditions are definitely overcome by the use of* ANEMOSTATS.

ANEMOSTATS can be installed inexpensively and quickly and are ideal for use on new or existing installations.

ANEMOSTATS produce these unparalleled results because they are the only air diffusers which operate on the following interdependent principles:

1 Air Expansion within the device, which reduces velocity instantly

2 True Aspiration, which causes room air to be drawn into the device where it is mixed with the supply air.

3 Creation of a multiplicity of air currents and counter-currents at low velocities, which causes slow but adequate secondary air motion.

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In every low-temperature insulation service

J-M ROCK CORK DOES THIS THREE-WAY JOB

ROCK CORK INSULATION on air-conditioning duct before application of cement finish.

Rock Cork provides permanent efficiency! Unusually moisture resistant, minimizes moisture infiltration . . . the cause of most low-temperature insulation failures. Installations made many years ago still retain their high insulating effectiveness . . . show no signs of deteriorating.

Rock Cork provides installation savings! Light in weight and easy to handle, Rock Cork can be quickly applied. On the job, costs stay low. For Rock Cork is basically mineral . . . rotproof, unusually durable. Little maintenance is required.

Rock Cork provides low initial costs! You pay no more for Rock Cork than for other low-temperature insulations. And you're sure of complete uniformity, for Rock Cork is made to an exact formula under rigid laboratory control.

You should have all the facts on the advantages J-M Rock Cork offers for use on refrigerating equipment, cold lines and air-conditioning ducts. Write for brochure DS-555. Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE
JM ROCK CORK
LOW-TEMPERATURE INSULATION. IN SHEET FORM AND FOR PIPE COVERING

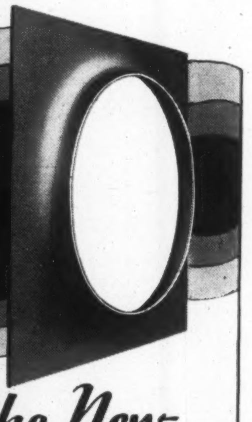
Coming Events

National Safety Council: Safety congress and exposition, October 6-10, Stevens Hotel, Chicago, Ill. Theme of the congress is to be "Help Defense—Stop Accidents," and there will be 552 program participants and 162 sessions. Headquarters office, 20 N. Wacker Dr., Chicago, Ill.

American Welding Society: Annual meeting, week of October 19, Bellevue-Stratford Hotel, Philadelphia, Pa., in conjunction with the National Metal Exposition at the Commercial Museum, Philadelphia. Headquarters office, 33 W. 39th St., New York, N. Y. Technical sessions are scheduled on piping and pressure vessels, weldability of plain carbon and low alloy steels, welding of high alloy steels, shipbuilding, railroad welding, aircraft and automotive welding, resistance welding, national defense, machinery welding and research. Piping and pressure vessel session, scheduled for Friday morning, October 24, includes papers on flame preheating and stress relieving arc welded, high pressure pipe lines, by P. T. Onderdonk and Werner Peterson, Consolidated Edison Co. of New York; welding pressure vessels, tanks and heat exchangers, by H. B. Schlosser, Edge Moor Iron Works; and radiographic examination of heavy plate, by O. R. Carpenter, Babcock and Wilcox Co.

Plumbing and Heating Industries Bureau: Annual meeting, October 30, Palmer House, Chicago, coincid-

INCREASE THE Efficiency OF YOUR AIR CONDITIONING SYSTEM



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With the New Venturi-Type FAN HOUSING

FOR THE FIRST TIME in the air conditioning field, a Presteel Fan Housing with the Venturi Section drawn down in one operation, is available as a standard item.

Increase the fan efficiency of your air conditioning system. Send today for the free folder and price list that give the full story of this new Commercial Fan Housing—its features, sizes and gauges available for exhaust fans, ventilating fans and unit heaters.

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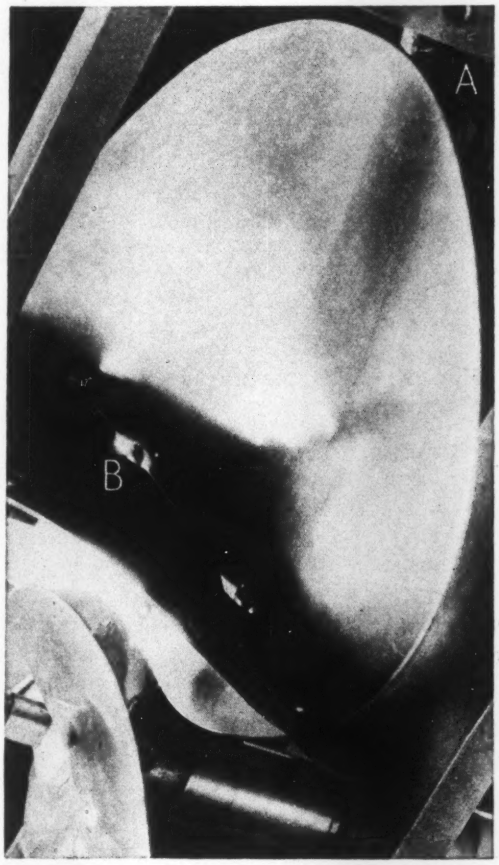
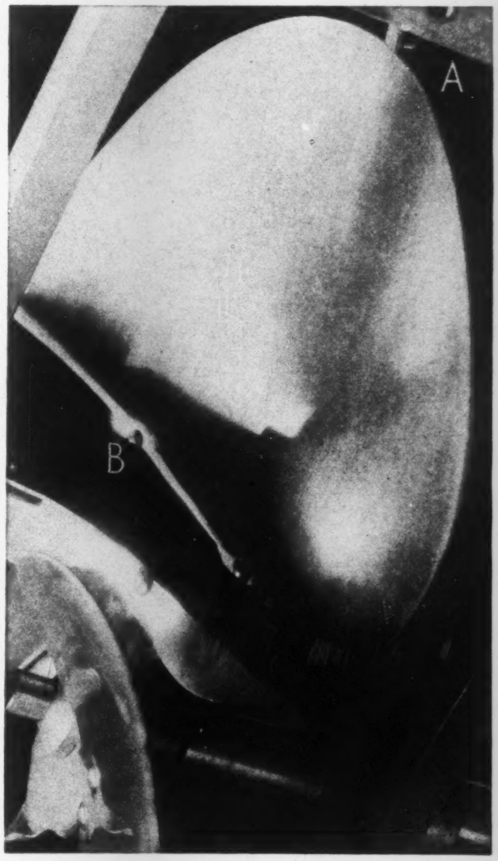
THE FIRM THAT IS FAMOUS FOR TANK HEADS, CIRCULAR SHAPES AND PRESSED STEEL PRODUCTS

Quiet Fan Blades don't *"Happen!"*

SKILLED HANDS must shape to a master jig the contour and pitch of every Airistocrat Quiet Propeller Fan Blade. Skilled hands must shape them to a contour that has been laboratory designed, tested, proved to be *best* for its purpose.

Graphic illustration of the condition of an average fan blade as it comes to the setting jig from the forming dies is presented at the right. The blade will not track properly, or have correct pitch, as it does not align with the indicator "A" and at the same time have its entire contour match the master "B". It will not run quietly, and will vibrate.





Therefore the hand work that brings these blades to uniformity is vital. Each and every blade must match its master contour with the same degree of perfection that can be seen in the illustration at the left.

Thus the attributes of which we speak so frequently: QUIET, BALANCED, DEPENDABLE, come into being.

If you are not acquainted with Airistocrat fan blades, or their companion line, Airotor blower wheels, write for catalogs. Our catalogs give complete specifications and *guaranteed* performance ratings — dependable ratings because the touch of skilled hands has made every impeller *uniform*.

TORRINGTON

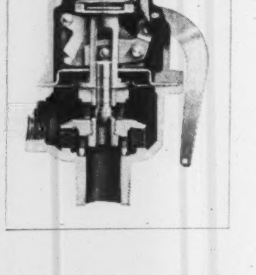
MANUFACTURING COMPANY, TORRINGTON, CONN.

Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, HEATING, PIPING AND AIR CONDITIONING and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Safety Relief Valves

No. 2182—A new valve has been added to the manufacturer's "No. 29" series of snap action safety valves. The new size, designated as "No. 129," is for hot water heating boilers, and has a large discharge capacity to take care of boilers with a gross output up to 350,000 Btu per hr. The idea of rating relief valves for hot water heating boilers in Btu output is a departure from the custom of designating them in terms of inlet size.



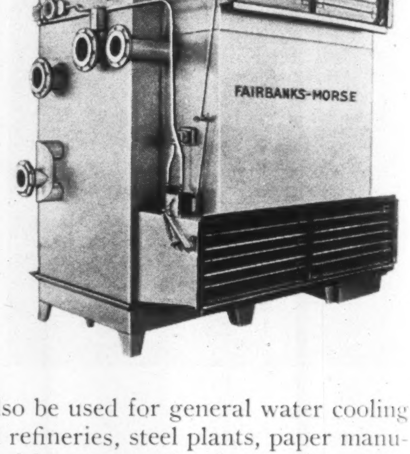
According to the announcement, far greater discharge capacity is necessary at high temperatures to prevent excess pressure and this has been provided by a snap action mechanism which opens up full orifice capacity when the set relief pressure of 29 psi is reached.

Features of the unit include flexible leakproof bellows and the stainless steel metal to metal valve.—McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.

Evaporative Coolers

No. 2183*—New and improved models of evaporative coolers for diesel engine jacket water using the principle of heat dissipation by evaporation of water have been announced. They consist essentially of a coil through which the jacket water is passed, nozzles to spray water on the coil and a blower to force air past the coils. Units are available which cool the engine lubricating oil in a separate coil within the same cooler as the jacket water. This simplifies piping and saves space

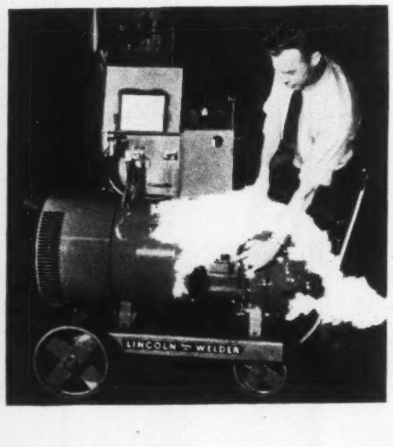
The coolers are designed primarily for indoor operation although units for outdoor installation may be secured with cooling coils of the finned type to permit air cooled operation throughout the winter season. The finned type coolers may also be used indoors in winter season to heat occupied spaces through branch lines of the air discharge duct.



These units may also be used for general water cooling in chemical plants, oil refineries, steel plants, paper manufacturing, etc.; for refrigerant condensing in air conditioning, milk plants, ice plants, breweries, packing plants and the like, and for miscellaneous cooling such as transformer cooling and broadcasting tube cooling.—Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.

Protective Control for Welding

No. 2184—Complete protection against heat or excessive current, or both, is provided by a new protective control device for arc welding machines, according to the manufacturer. The device consists of two current transformers, the primaries of which are connected in series with the motor leads and the secondaries supplying power to operate two snap action thermostats which are mounted directly on the motor lamination. These thermostats are connected to the lamination in such a way that they operate by means of heat conduction as well as by current passing through the thermostat.



The protection provided by this device is explained by the manufacturer as follows:

1) If the welder is being operated in a very hot room or an oven and it exceeds the safe operating temperature, thermostats will trip open.

2) If the motor is cold and excessive currents which will eventu-

For Your Convenience

HEATING, PIPING AND AIR CONDITIONING, [11-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2182	2183	2184	2185	2186	2187	2188	2189	2190	2191
2192	2193	2194	2195	2196					
4020	4021	4022	4023	4024	4025	4026	4027	4028	4029
4030	4031	4032	4033	4034	4035	4036	4037	4038	4039

Name.............................. Title....................
Company ....
Address ....
City.............................. State....................

ally damage the motor occur for a short period of time, the thermostat will operate before the motor reaches an unsafe temperature.

3) If the machine is started on single phase lines, the switch may close, but the excessive heating of the thermostat caused by the single phase locked current will open the thermostat and stop the machine.

4) If the machine is running and one fuse blows so that the motor is operating single phase, if the load on the machine is sufficient to overheat the motor the thermostats will trip out.

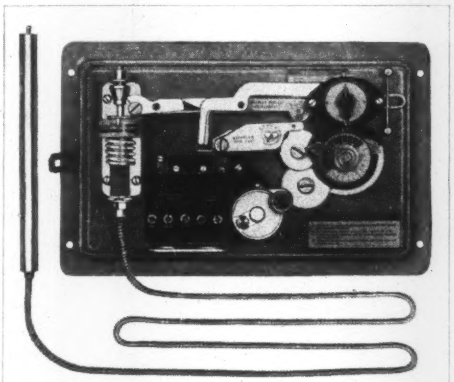
5) If the rotor is locked with normal three phase power applied, the thermostats will open the circuit due to the high current.

6) If the welder is operated for long periods of time at sustained overloads, both high input current and high motor temperature combine to open the thermostats.

The thermostats automatically reset when the motor returns to a safe operating temperature or when the current is reduced, and no manual operation is required to start the machine, except pushing the start button.—Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio.

Heating Regulator

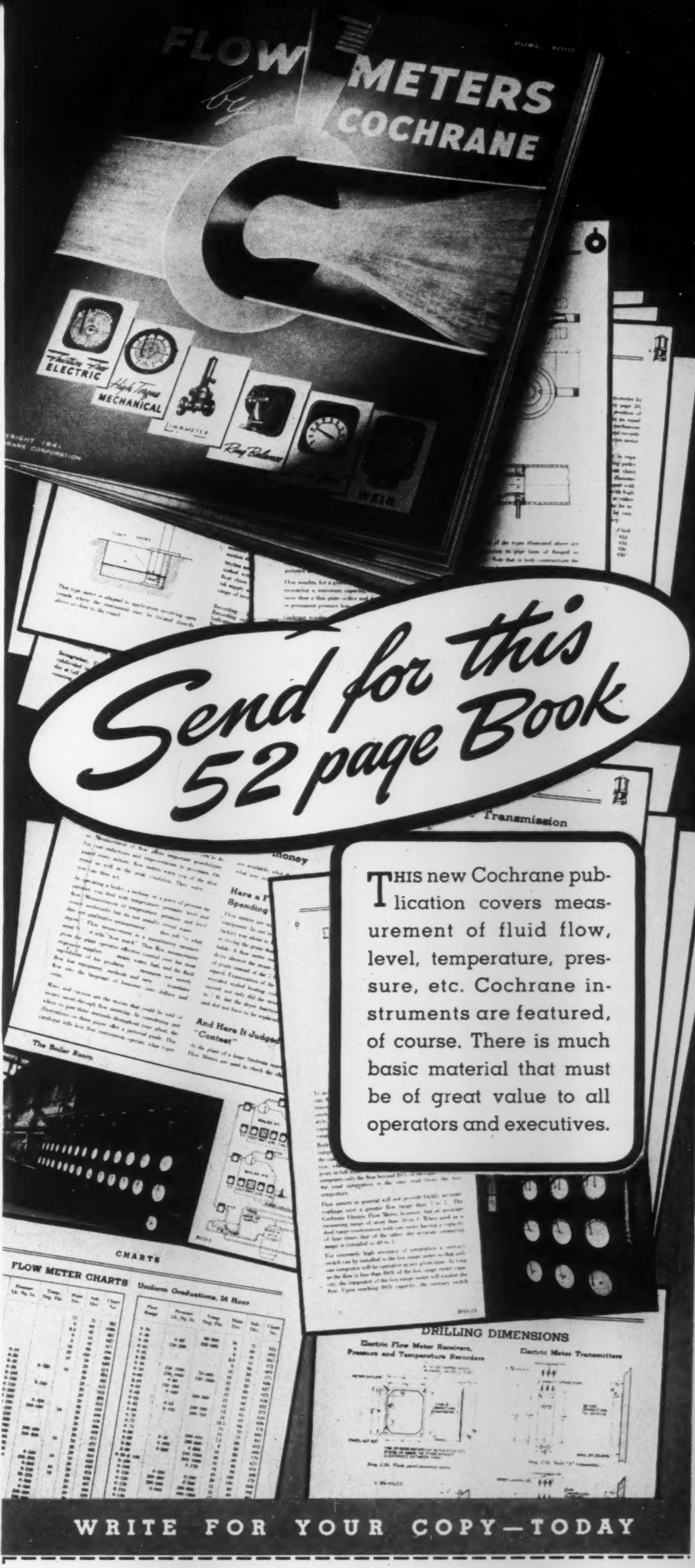
No. 2185—A new heating system regulator which controls heating in accordance with outside temperature and which programs heating according to the hours of activity and outside temperature is known as the "Model 7 Tri-trol." It offers in one compact instrument all the various controls and switches necessary for completely automatic heat regulation based on outside temperature, says the maker, and is particularly suited for multiple occupancy buildings, such as hotels, factories, apartments, stores, offices, schools, etc.



The regulator automatically changes the starting time of the system each morning in accordance with outside temperature changes to assure comfort at the start of the day. During the day it operates the system often enough, and long enough—as guided by outside temperature—to maintain even, comfortable inside temperature. At night it shuts down the system—again automatically, in accordance with the outside weather. Incorporated in the regulator are such built-in features as a hold-fire switch, an automatic cut-off when outside temperature rises above 65, and a special four position switch which provides added flexibility for those buildings [illegible] require varied heating programs.—Marsh Tri[illegible] S. Michigan Ave., Chica[illegible]

Centrifugal Refrigerat[illegible]

No. 2186—During the past year a new line of liquid cooling systems for air conditioning and industrial process requirements has been developed. The centrifugal



THIS new Cochrane publication covers measurement of fluid flow, level, temperature, pressure, etc. Cochrane instruments are featured, of course. There is much basic material that must be of great value to all operators and executives.

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3131 N. 17th St., Philadelphia, Pa.

Please send me a copy of Cochrane Publication 3010 on Flow Meters.

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compressor is of the volute design as opposed to the diffuser design that has heretofore been used in this field.

Many new and unusual features are incorporated in this design: notably, dual lubrication, and balancing of end thrust and side thrust by arrangement of impellers and volutes. These systems are available in a wide variety of sizes covering a range from approximately 150 to 1200 tons refrigerating effect.

This product has had a very wide use in the national defense program in connection with air conditioning of blackout or controlled temperature plants for the precision manufacture of aircraft and aircraft engines.—Worthington Pump and Machinery Corp., Harrison, N. J.

Modulating Steam Control System

No. 2187**—An improvement in the manufacturer's No. 40 modulating steam control system for installation on one or two pipe steam heating systems in educational buildings, hospitals, sanitariums, apartment buildings, industrial plants, etc., has been announced. This model now operates in conjunction with a three-point control thermostat which is said to maintain inside temperatures within a narrow temperature range of plus or minus 1 F.

The control operates in three stages: namely, predetermined ounces of pressure, predetermined pounds of pressure, and an all-off position. There is a constant modulating action in the pressure stages.—Major Controls Sales Div., 12 Norfolk St., Cambridge, Mass.

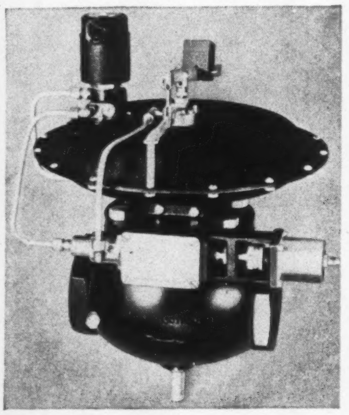
Electric Heat Elements

No. 2188**—Developments in the manufacture of "Black Heat," an element constructed in a unique process by which electric filaments of subglow temperature are interwoven with spun glass and other insulating materials, in the fields of airplane construction, wall board heating and chicken brooder heating were announced recently.

Manufacturers of wall board are said to be working with such heat elements for warming walls of rooms. Experiments are also being conducted looking to the casting of the heat element in copper sheets, or placing it between two sheets of metal for lining walls and heating submarines and other naval vessels, as well as other numerous places where space for heating is at a premium. —Heat Elements, Inc., Buffalo, N. Y.

Gas Valve

No. 2189—A new combustion control with an integral governor regulates the fuel supply to the gas burner in direct relation to the steam pressure. This diaphragm operated valve is electrically piloted and acts to maintain a constant steam pressure at all times by throttling the gas flow and air damper in direct proportion, yet eliminating "hunting," according to the manufacturer.



An additional feature is the fire adjustment which sets the minimum

Accuracy to Millionths of an Inch with

The parts for tanks, planes and guns, produced in thousands of separate plants, can only fit together properly if made in standard sizes, to accurate gages. Pratt and Whitney secure accuracy to millionths of an inch by finishing their Hoke precision gage blocks in this air conditioned room at West Hartford, Connecticut.

Standard conditions of 68° F. and 50% relative humidity are maintained, 24 hours a day the year round, with Frick Equipment. This working space, covering 16,800 sq. ft., is believed to be more accurately controlled than any other of like size in existence. Full credit is due the Automatic Refrigerating Co., Frick Distributors at Hartford.

Put your air conditioning problems up to the experts who have nearly 60 years' experience back of their recommendations. Write **FRICK CO., Waynesboro, Penna.**

TRADE FRICK MARK

Air Conditioning

WATSON-STILLMAN
FORGED STEEL FITTINGS
WELDING and SCREW END
BULLETIN A3

Why it pays to Buy and Use

W-S FORGED STEEL FITTINGS

COMPLETE LINE—No line of fittings is more complete; of higher quality; or better made than W-S Forged Steel Fittings. Switching from line to line to meet your fittings requirements is eliminated when you buy and use W-S Fittings.

W-S Forged Steel Fittings in both socket welded and screw end types, are quality built in a wide range of capacities to fulfill stiffest kind of high speed, free-flowing, pipe line service. They are forged from steels possessing extra toughness, strength and resistance to temperatures and shock.

QUICK SERVICE is given distributor requirements; a benefit which means the best possible deliveries, assuring customer satisfaction.

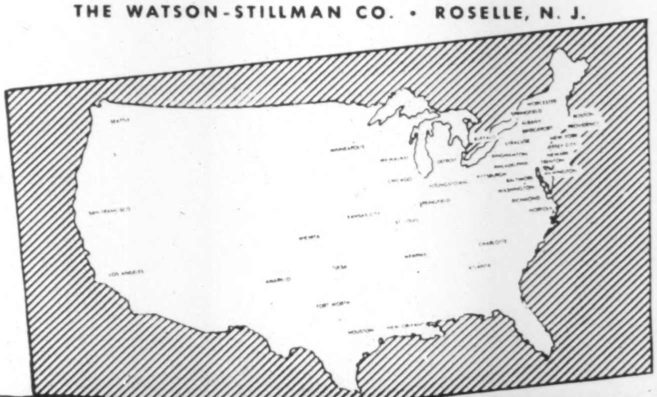
W-S have an active interest in the distributor's business and his progress because W-S was founded and built by following a strict policy of selling only through authorized stock carrying distributors. Today in more than 40 leading industrial centers throughout the United States, W-S Forged Steel Fittings flow smoothly through better than 150 different closely associated distributing outlets.

EXTRA BUYING HELP—As our national emergency mounts, time becomes an ever increasing factor in the purchasing of materials and finished products. This means new, reliable sources of supply will be needed to meet the increasing demands of industry. That's where you will find this W-S Forged Steel Fittings book a helpful guide.

Bulletin No. A-3 shows in detail the sturdy construction and inside reasons for the long life, exceptional resistance to wear and low maintenance cost of W-S Forged Steel Fittings.

You need this book to eliminate many of those unnecessary details in seaching for a quality line of forged steel fittings. Get it—Study it—Use it to enlist the large facilities of W-S Forged Steel Fitting Division and distributor outlets.

THE WATSON-STILLMAN CO. • ROSELLE, N. J.



WATSON-STILLMAN

663

Is Your Plant Hard to Heat?

the

DIRECTHERM Heater

gets more heat out of your fuel

It utilizes about 80% of the invested fuel energy. No duct work, no radiator or pipes are needed. The heat is discharged directly into the room without any waste, and evenly distributed as far as 200 feet away.

To install a Directherm is almost as easy as to set up a kitchen stove; and "maintenance" is an unknown word in the Directherm dictionary.

May we give you figures and details about this economical way of heating your plant? Just write for bulletin 305-A.

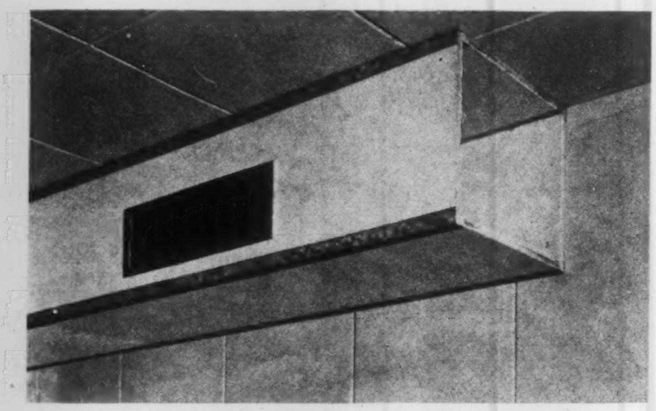
AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE.
ST. LOUIS, MO.

amount of fuel supplied to the burner.

The gas pressure range is from $2\frac{1}{2}$ in. water column to 5 psi, and the governors available for a wide range of steam pressures.—General Controls Co., 801 Allen Ave., Glendale, Calif.

Duct Construction

No. 2190**—"Insulduct," a patented system of duct construction used for the past five years, is now offering an alternate construction with asbestos lining and metal corners. According to the manufacturer, the use of asbestos lined ducts made of insulating board with metal corners and turning vanes requires less than one-fourth the amount of metal used in the usual system and incorporates such advantages as sound absorption, light weight, insulation, and a neat appearance that does not require concealing.

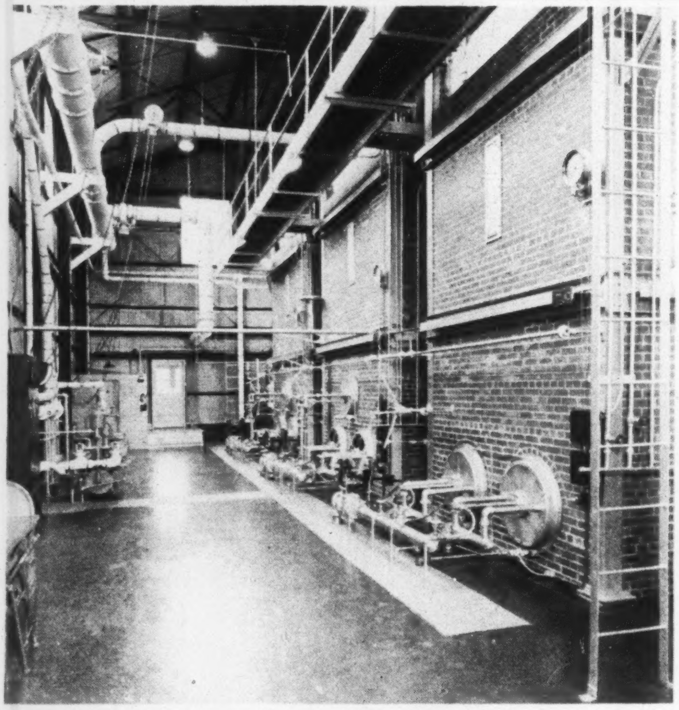


The sides of the duct are cut from insulating board which has a 16 lb layer of sheet asbestos glued under pressure to one or both sides with fireproof cement. Thicker board may be used if more insulation is necessary. Metal corners, butt joints and turning vanes enable the average workman to assemble ducts on the job from panels cut from large sheets of board either with a hand saw or in the shop on a power saw. A special cement and a caulking compound are used in the joints and fastenings with sheet metal screws insure a permanently tight and substantial installation, it is stated.

Since the ducts are installed hard against the ceiling or wall they resemble beams or pilasters and may be painted to match walls. If it is desired to plaster over the ducts, an insulating board is used which has a plaster base finish and the corners are reinforced with expanded metal corner beads and the plaster is applied direct to the duct.—Smith-Raymond Co., 1008 13th St., Columbus, Ga.

Air Conditioning Smoke Control

No. 2191**—One of the newest applications of photoelectric controls is in the field of ventilating and air conditioning. A photo-electric unit has recently been developed of sufficient sensitivity to operate when the air contains 10 per cent smoke, according to the manufacturer. By means of such units, dampers may be closed; fans shut off, and visible or audible signals oper-



Quality Always

Even under the pressure of defense production Webster engineering and high quality of workmanship is maintained

In the O'Reilly General Hospital of the U. S. Army at Springfield, Mo., Webster Burners have been installed.

The two 400 h. p. water tube boilers are equipped with 3—Series 200 Radiant Combination Gas and Oil Burners and Protectoglo in each boiler. The one 300 h. p. water tube boiler is equipped with 2—Series 200 Radiant Combination Gas and Oil burners and Protectoglo.

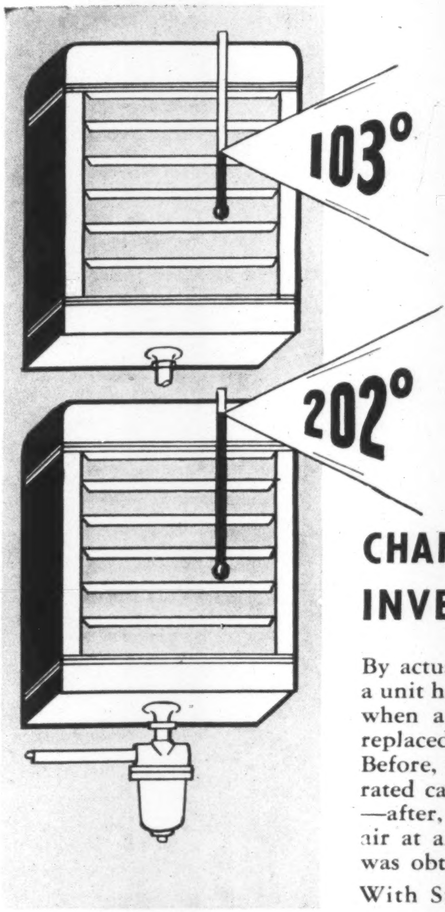
The entire plant is automatically controlled by a Series 13-V Webster Precision Combustion Control with an air operated prime mover.

Write for Series 200 bulletin

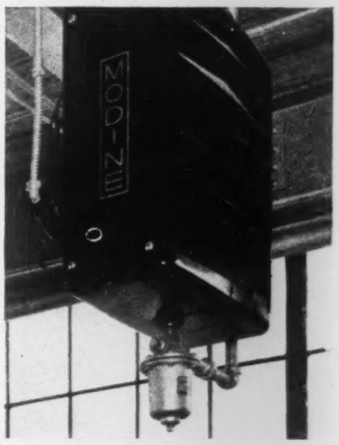
THE WEBSTER ENGINEERING Co.

TULSA —DIVISION OF— **OKLAHOMA**

Surface Combustion Corp. . . . . .Toledo, Ohio



BEFORE *and* AFTER



CHANGING TO SUPER-SILVERTOP INVERTED BUCKET STEAM TRAP

By actual test, delivered air temperature of a unit heater was increased in excess of 33% when an Anderson Super-Silvertop trap replaced a temperature actuated steam trap. Before, the unit heater output was less than rated capacity due to time lag of discharge —after, heater was free of condensate and air at all times and maximum heat output was obtained.

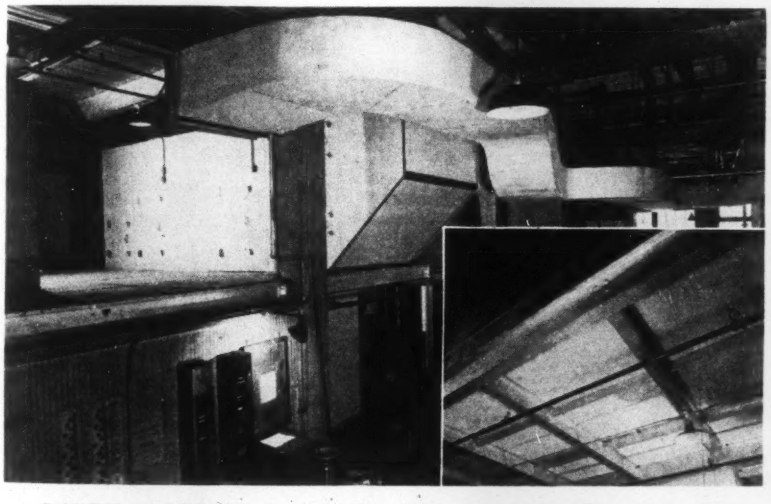
With Super-Silvertop, mere presence of water or air opens the discharge valve—no cooling leg is required to pull the temperature down and no delay occurs while waiting for that drop in temperature.

Don't blame your unit heaters or other equipment for poor performance. Check first to see that the unit is well drained. For proper size of trap, refer to book "How To Choose a Steam Trap." A copy of this book is free for the asking. Shall we send you one?

THE V. D. ANDERSON CO.
1949 W. 96th Street • Cleveland, Ohio

For *Better* AIR CONDITIONING HOUSINGS and Conservation of Sheet Metal... *use*

Carey FIREFOIL PANELS



CAREY FIREFOIL PANELS used in air conditioning job at The William Powell Company's No. 2 plant, Cincinnati. This material was used for the floor and walls of the plenum and as a ceiling over the washroom below the air conditioning equipment. Insert shows the flooring panels.

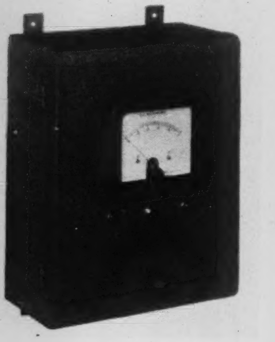
THE rapid development of air conditioning has called for a housing material that is strong, rigid, fireproof and sound-deadening. Engineers and contractors find in CAREY FIREFOIL a product that ideally meets the requirements, at the same time conserves metals for defense needs.

CAREY FIREFOIL is a hardened asbestos insulating board, consisting of corrugated asbestos felts, firmly bonded and surfaced on each side with asbestos-cement sheathing. Designed especially for constructing plenum chambers, large ducts and housings for air conditioning and other equipment.

CAREY FIREFOIL is a structural insulator; eliminates vibration; is waterproof; light in weight. Will not rust; requires no paint. Maximum size sheets, 48" by 96", in thicknesses from ½" up. Bring your air conditioning up to date with CAREY FIREFOIL. Write today for full information—address Dept. 25.

•

THE PHILIP CAREY MFG. COMPANY, Lockland, Cincinnati, Ohio
Dependable Products Since 1873
IN CANADA: THE PHILIP CAREY COMPANY, LTD.
Office and Factory, Lennoxville, P. Q.



ated to prevent damage by smoke conveyed through air conditioning or ventilating duct work.

The equipment comprises three self-contained units. There is a light source unit and a photo-cell unit; a change in light density passing between the two will vary the effective density of the light beam which is cast on the photo-electric unit by the light source. This variation is transmitted to the third unit, which is the control panel.—Worner Products Corp., 1019 W. Lake St., Chicago, Ill.

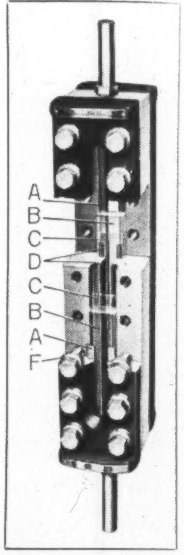
Air Conditioning Service

No. 2192—A new program was recently announced designed to insure adequate service facilities and proper installation of portable air conditioning equipment. According to the announcement, authorized refrigeration and portable air conditioning service stations will be carefully selected and will be kept informed and equipped to render the best service possible in installation and maintenance of the manufacturer's products.

The manufacturer's field service engineers will conduct meetings explaining the equipment and first-hand information will be available from the distributor's service manager and the service and parts departments. Service bulletins will describe details of installation, principles of operation and include technical information and other material of importance on all types of units.

Application forms are obtainable from the manufacturer's distributors. There are two kinds, one for refrigeration service only, and others for portable air conditioning service. When the applications are approved, the appointed organization receives a certificate suitable for display and its name is placed on the mailing list to receive the special information to be issued from time to time.—Philco Corp., Tioga and C Sts., Philadelphia, Pa.

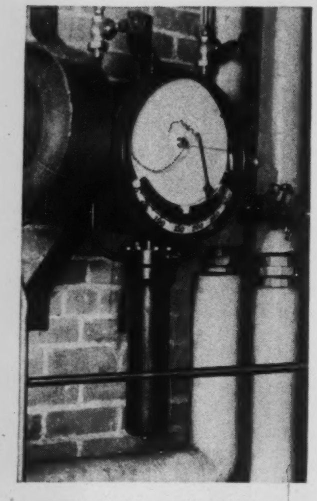
Water Level Gage



No. 2193—An improved, pressure sealed, flat glass insert for boiler water level gages is built for pressures up to 1500 psi. The outstanding features of the improved design are pressure sealed gaskets on the inside faces of glasses and special spring loaded cap screws holding down the front and back cover plates, according to the manufacturer.

Referring to the sectional illustration, cushion gaskets (A) are used on outer faces of glasses (B). Thin sheets of india ruby mica (C) protect inner surfaces of the flat glasses from etching action of steam and water. The special pressure sealed molded "Vulcabeston" gaskets (D) fit into body recesses on

The ADSCO FLOW METER, Orifice Type
ACCURATELY METERS STEAM, WATER, COMPRESSED AIR OR GAS.
SIMPLE IN CONSTRUCTION - - EASILY INSTALLED



A Typical Installation by a District Heating Company

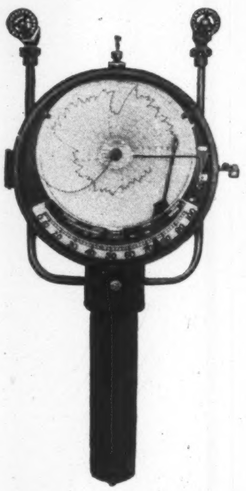
Free Floating, Frictionless Meter Mechanism transmits flow to direct-reading, evenly-divided chart

The ADSCO Flow Meter has a record of exceptional accuracy at all rates of flow. It is highly sensitive to fluctuations in flow but cannot be damaged by sudden overloads or reverse flows. Simple and rugged in construction — easily installed and maintained — requires no frequent inspection or adjustments.

Available with recording chart, indicating scale and integrator counter to totalize the flow or in other combinations of these three devices.

Correspondence is invited regarding your metering problems so that ADSCO may make recommendations based on over 25 years experience in the manufacture of meters.

Write for Bulletin No. 35-83HP



AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.
IN BUSINESS OVER SIXTY YEARS

pressure side of glasses and provide tight joints between body and glasses without excessive tightening down of covers, thereby prolonging the life of these flat glasses in high pressure service.

Special shouldered cap screws are used to fasten cover plates to body. Spring cones (F) attached to each cap screw limit the amount of pressure on glasses and gaskets, preventing harmful compression on glasses when covers are tightened down, taking up expansion and contraction and allowing for slight variations in thickness of covers, glasses and gaskets.—Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.

Temperature Indicator

No. 2194—Where a large number of thermocouple temperature readings are to be taken, the new automatic indicator illustrated does the job in minimum time and requires minimum skill, according to the manufacturer.

As many as 50 couples can be used with one instrument. All of them are individually connected to toggle switches on the indicator front. To read a temperature, the operator simply throws the proper switch and a pointer moves automatically to the correct scale position.—Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

Regalvanizing Process

No. 2195**—A patented process permitting the welding of galvanized or other sheets and structural metal parts, regardless of size, so that the joints are left in a rustproof condition, has been made generally available. In the case of welded joints of galvanized material, regalvanizing is accomplished at the time of welding and no redipping is necessary.

An additional feature of the process, according to the announcement, is that it permits the painting or enameling of a welded joint without danger of sweating. The necessity of applying a filler coat before finishing such a joint is eliminated. The surface can be baked.—Galv-Weld, Inc., Mutual Home Bldg., Dayton, Ohio.

Controller

No. 2196—New features—principally refinements for better appearance and closer control—are incorporated in the new "Model 30 Stabilog" controller for full proportional control with automatic reset of the control point. This instrument comes in a new universal rectangular case, combining convenience with attractiveness. When panel mounted, it extends only ¾ in. from the panel surface; the door is recessed and hinges and hasp

DOUBLE PROTECTION
for air-conditioning ducts when they're lined with
J-M AIRACOUSTIC SHEETS

AGAINST NOISE . . . You'll be guarding against complaints about noise in your air-conditioning installations if you line ducts with J-M Airacoustic Sheets. This modern material soaks up 70% of all noise that strikes it. And its cost is so low that you can include duct quieting in every estimate.

AGAINST FIRE : : . Air-conditioning systems lined with J-M Airacoustic Sheets are safer. Because this modern material is basically mineral, it will not flame . . . introduces no fire hazard. Your clients will appreciate this extra protection.

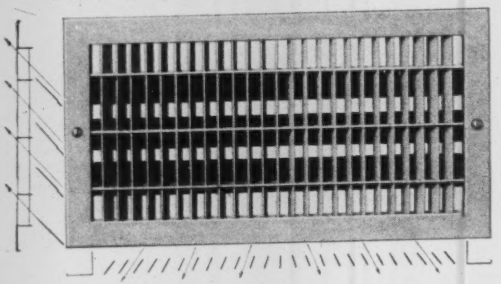
• • •

YOU CAN USE J-M Airacoustic Sheets for lining any type of duct. They are light and easy to handle . . . simple and economical to apply. On the job, their unusual moisture resistance offers protection against humidity . . . keeps maintenance at a minimum. For details, write for brochure AC-23A. Address Johns-Manville, 22 East 40th Street, New York, N. Y.

JOHNS-MANVILLE JM PRODUCTS Johns-Manville
AIRACOUSTIC SHEETS
FOR DUCT LININGS

INDEPENDENT "Fabrikated" REG. U.S. PAT. OFF.

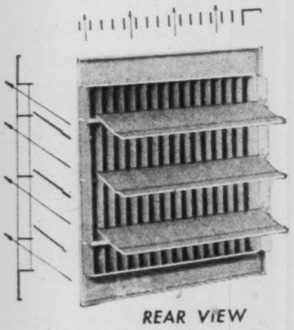
DIRECTED AIR FLOW GRILLES with Deflecting Vanes



No. 321A

Gives Compound Direction to Air Flows with Certainty

Each grille bar can be adjusted individually to direct air flow to the right, left or fanwise as illustrated. Adjustment can be made either before or after installing. Grille bars remain firmly in position without locking, and will not vibrate nor rattle.



REAR VIEW

Horizontal deflecting vanes in back may be individually adjusted to give upward or downward deflection to air flow.

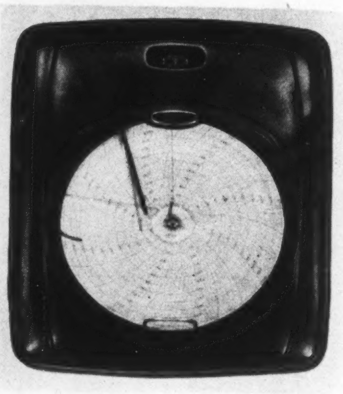
EVERY GRILLE BAR IS INDIVIDUALLY ADJUSTED

Send for Catalog No. 41-AC

641

THE INDEPENDENT REGISTER CO.

3747 E. 93rd STREET • CLEVELAND, OHIO

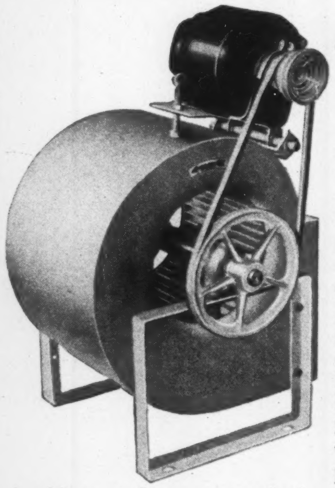


are flush with the door surface. A dual pressure indicator, replacing the customary two small gages, is easily seen through a rectangular opening in the door.

All operating adjustments are made from the front of the case, the adjusting mechanisms for change of control point, throttling range and reset resistance being immediately accessible when the door is opened. But the entire operating mechanism is protected and concealed behind a removable plate. Unit construction simplifies replacement of the measuring system, changing the type of control, or any other major servicing of the mechanism that may ever be necessary, says the maker.—Foxboro Co., 106 Neponset Ave., Foxboro, Mass.

For your convenience in obtaining more information about any of this equipment, see coupon on page 126. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

Tailored to fit your needs!



Whenever you plan a forced air or ventilating installation, it will be worth while to consider REX Blowers. Contractors prefer them because of their adaptability, quiet performance and sturdy construction.

There are eleven sizes with capacities ranging from 400 to 32,000 C.F.M. through various drive combinations. Motors and discharge outlets can be located to suit your requirements.

Without obligation, we will be glad to analyze your problem and recommend the proper REX Blower that will operate most effectively at lowest cost. Meanwhile, send for a copy of our new blower catalog No. 222 to aid you in selecting the right blower equipment.

Air CONTROLS INC
Div. of
The Cleveland Heater Co.

1937 W. 114TH ST. CLEVELAND, OHIO

Briefly Noted . . . .

James W. Parker, vice-president and chief engineer of the Detroit Edison Co., was elected by a letter ballot of the 15,000 members of the American Society of Mechanical Engineers to be president of the society during 1942.

In line with "the defense trend to repair rather than replace industrial and commercial equipment" and also to maintain close contact with regular customers during the present emergency, the York Ice Machinery Corp. has organized a new accessory equipment and maintenance sales department, under J. L. Rosenmiller. Fred C. Wood has been appointed manager of York's air conditioning department. He will devote much of his attention to the application of industrial air conditioning to vital defense production. Anker Winther, assistant general sales manager of the corporation, will supervise the activities of the newly combined advertising and sales promotion department. Frank Chalmers, who formerly handled advertising exclusively, will function in the new department not only as a specialist in advertising but will participate in sales promotion functions as well.

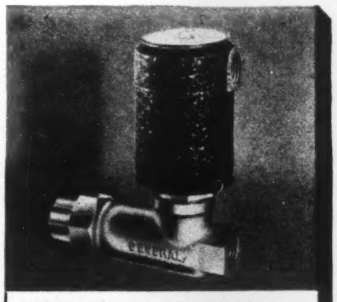
Clarence E. Scott has been made sales manager of the air conditioning division of Fedders Mfg. Co., Inc., it was announced recently, taking the position formerly held by Edmund R. Walker who is assistant general manager of the company.

Wallace W. Lockwood has been appointed advertising manager of the Taylor Instrument Companies.

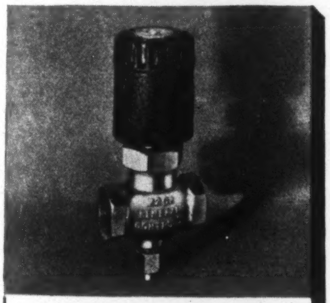
Fred Belser has been made general manager of the Ric-wil Co., and A. V. DeFosset has been appointed publicity director.

J. M. McClintock was appointed interim president of the Stoker Manufacturers Association at a special meeting of the executive committee held last month. He succeeds Frank Hoke, who resigned to become Indiana state director of contract distribution service for the OPM.

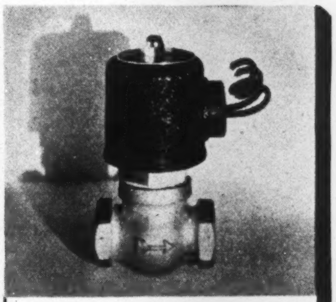
GENERAL
CONTROLS
SOLENOID
VALVES
★
SUITABLE FOR ALL SERVICES
HANDLE LIQUIDS, GASES,
VAPORS AND REFRIGERANTS



TYPE K-10—Magnetic valves for controlling light and heavy oils, water, air, gas, steam, ammonia.



TYPE K-15—Pilot piston operated for low and high pressure duty on air, gas, water, light oil and all refrigerants.



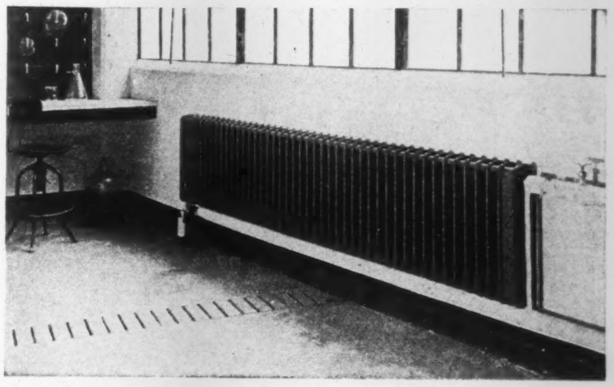
TYPE K-20—Single seated valves; ideal for use as humidity control, gas ignition, light oil valves, pilot valves.

Come to headquarters for all your needs; Pioneers and leaders in the manufacture of quiet, trouble-free, 2-wire controls for all services—Ask for catalog.

GENERAL CONTROLS
801 ALLEN AVENUE GLENDALE, CALIFORNIA
BRANCH OFFICES: BOSTON • NEW YORK • PHILADELPHIA • ATLANTA • CLEVELAND
DETROIT • CHICAGO • KANSAS CITY • HOUSTON • DALLAS • SAN FRANCISCO

DURABLE

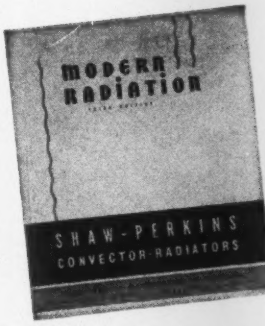
Substantial construction assures long life!



SHAW-PERKINS
HEATING UNITS

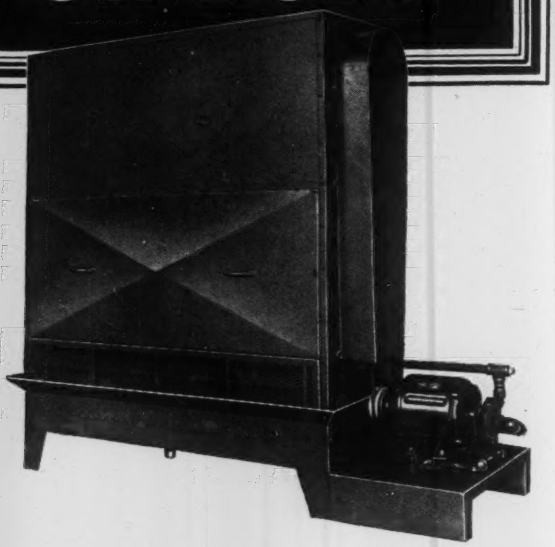
When you specify and install Shaw-Perkins radiators, you automatically guarantee long years of highly satisfactory heating performance. The substantial steel construction, with the heating element enclosed in a heavy corrosion-resistant tube, is full proof of the durability of Shaw-Perkins radiators—and the attractive, conservative styling is insurance against obsolete appearance later on.

The elimination of the possibility of annoying and expensive service calls means you'll enjoy your full margin of profit and gain the confidence and recommendations of your customers. Why not acquaint yourself today with the modern Shaw-Perkins line? Full information gladly sent on request.



Write Today
for this
Booklet

SHAW-PERKINS MFG. CO.
Oliver Building
PITTSBURGH, PENNSYLVANIA



MARLO PRODUCTS ON DUTY

Marlo Products are on duty in Aircraft, TNT, Small Arms Ordnance, Bomber Assembly, Aircraft Engine Plants, Army Cantonments, Hospitals, Research and Experimental Laboratories.

BUY MARLO EQUIPMENT WITH CONFIDENCE

Fin Coils
Unit Product Coolers
Evaporative Condensers
Brine Spray L.T. Units
Industrial Coolers
Air Conditioning Units
Low Temperature Electrical Defrosting Units

Write for Bulletins

MARLO COIL COMPANY

6135 Manchester Ave., St. Louis, Mo.

★ ★ ★

Useful Information

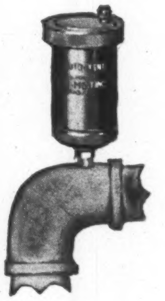
Conserving Men, Money and Materials

In times like these, when industry is confronted with emergency production demands, the need for more effective accident controls in order to conserve men, money and materials becomes of paramount importance. Plant expansion, development of new processes, maintenance of heavily worked equipment, employment of new workers and other similar problems call for more than usual ingenuity and skill on the part of management, if a "job" is to be done not only well but safely.

These vital considerations are emphasized in a new report issued by the industrial safety section of the Metropolitan Life Insurance Co. The report is entitled, Conserving Men, Money, and Materials in Essential Industries. It is basically a discussion check list for the industrial executive concerned with emergency production.

The report lays particular stress on the proper consideration of accident costs. Of far greater significance than the threat of personal injury accidents are the enormous potential losses of precious time and the spoilage of equally precious materials that result from mishaps sometimes termed "near accidents"—indirect losses which are generally overlooked in compiling accident reports or statistics, yet which to the production executive represent very real items of industrial waste.

GET THAT AIR OUT OF THERE



WITH AN AUTO-VENT AIR ELIMINATOR

Air is all right in its place, but when it traps or retards the free circulation of liquids, it can and does cause no end of trouble. The MAID-O'-MIST No. 7 Auto-Vent Air Eliminator will quickly vent air from hot or cold circulating lines, concealed radiators, unit heaters, tanks, diesel engines, cooling manifolds, etc., and keep the liquid flowing. Simple in construction, positive in action, and lasts indefinitely. Put one in a real tough spot and be convinced.

Catalog sheet 107 lists the complete Maid-O'-Mist Line of Humidifiers for steam, hot water and warm air heating systems. Write for it today.

MAID-O'-MIST INC.
AUTOMATIC HUMIDIFIERS FOR ALL TYPES OF HEATING SYSTEMS
211 NORTH ABERDEEN STREET
CHICAGO ILLINOIS

As an aid to the study of industrial accidents and to point up proper means for their control, the report briefly develops several fundamental considerations for employee safety.

Copies of this report are available to executives who address the bureau on their business stationery. Address: Policyholders Service Bureau, Metropolitan Life Insurance Co., 1 Madison Ave., New York, N. Y.

Thermodynamics of Boiler Feeding

The Hydraulic Institute, 90 West St., New York, N. Y., has published the first prize winning essay in its first annual engineering essay contest—Thermodynamics of Boiler Feeding, by Igor J. Karassik, application engineer in the centrifugal pump sales division of Worthington Pump & Machinery Corp. Copies of this 39 p. paper are available from the institute for 50c.

Mr. Karassik presents a description of feed cycles in general, a discussion of pumping power and mechanical problems with relation to feedwater temperature, an analysis of temperature rise in boiler feed pumps and discussion of minimum permissible capacities, a review of thermodynamic efficiency of boiler feed pumps, and a section on disposal of bypass and leak-offs.

In conclusion, he says that while the power consumption of boiler feeding equipment is but a small portion of the total power generated in a steam power plant, a complete analysis of the thermal phenomena which take place in this equipment will serve to increase its reliability even though the final effect on the plant over-all efficiency is almost negligible. For this reason, steam power

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Information on Insulation...

Get in touch with . . .

MUNDET CORK CORPORATION
65 SOUTH 11TH STREET
BROOKLYN, N.Y.

MUNDET
CORK INSULATION
CONSERVES LOW TEMPERATURE

AS AMENDED BY THE HEATING TRADE:

PETRO
Cuts Steam Costs
"Service" also

Some Heating Contractors have available service assistance for firing plants they install; some do not—

Both groups know service, when necessary, increases operation cost and the less service required the better the customer likes the installation as made.

Both groups also know what a wide gap can exist between equipment in a catalog (or specification) and that same equipment in a boiler.

The heating man's job is to bridge that gap, and whether he likes it or not—whether he does the servicing or not—any necessity for excessive service reflects on the contractor in the mind of the plant owner.

PETRO "DESIGNS IT *OUT*"

With Petro Systems, both contractor and plant owner are assured a remarkable freedom from service.

This is true regardless of whether the system was installed for manual operation with "cold" oil, or completely automatic operation with pre-heated oil, or any degree between.

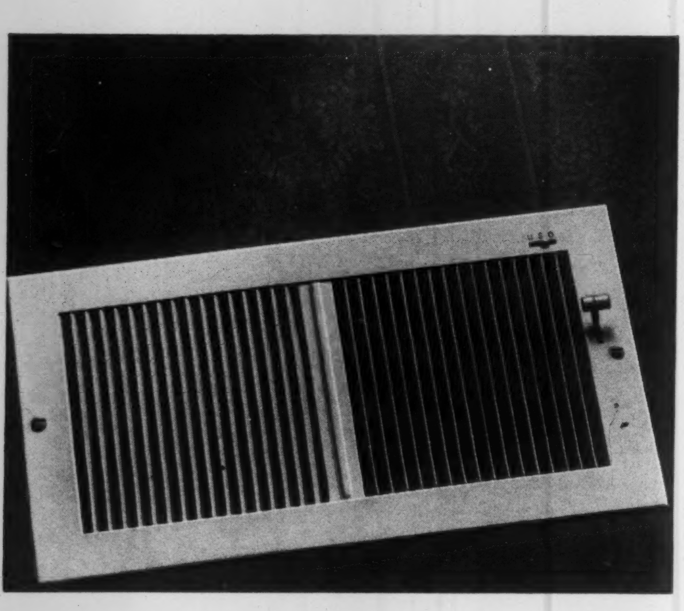
Costly "cut and try" wastes in installation are eliminated with Petro.

The burners are available in so wide a range that the contractor can select exactly the size and capacity needed. Petro's "lay-outs" and engineering suggestions are practical, economical, and efficiently complete. They are not "general" but apply specifically to the job in hand.

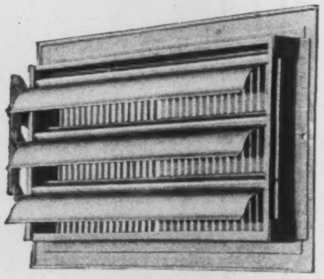
Added to the widely recognized excellence in Petro equipment, these things safeguard the contractor against having to put his profit in escrow to cover "second guess" costs for correction. They help him install a clean finished system which will deliver a firing operation that will add to his prestige.

FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S

PETRO
OIL BURNING SYSTEMS
PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT



THE Auer Airo-Flex "4000" line gives you a modern air conditioning register with every worthwhile feature. The multi-louvre back blades, operated by lever, direct the air flow at any desired angle upward, straight, or as much as 22½° downward. Indicator on face shows position of blades. Register grille bars are adjustable also, with turning tool furnished, for any combination or single flow, straight, right, or left. This is a simple, practical, and highly economical register.



Back view of Airo-Flex No. 4432 Register

Send for complete Auer Register Book 41 illustrating all Auer Air Conditioning and Gravity Registers and Intakes. Separate Catalog "G" also available on Auer Grilles.

THE AUER REGISTER COMPANY
3608 Payne Avenue Cleveland, Ohio

AUER REGISTERS & GRILLES
For Air Conditioning and Gravity

plant designers can derive important benefits from a thorough knowledge of the thermodynamics of boiler feeding.

Kansas City Weather

Just about everything anyone would like to know about weather in Kansas City, Mo., is covered in supplement No. 44 of the Monthly Weather Review (WB No. 1316) published by the weather bureau of the U. S. department of commerce and available from the Superintendent of Documents, Washington, D. C., for 20c.

Prepared by Andrew M. Hamrick and Howard H. Martin, it reviews 50 years of weather in Kansas City from 1889 to 1938. There are sections on temperature; humidity; wind, weather and sunshine; precipitation; snowfall; hail; and a study of the drought period from 1929 to 1938.

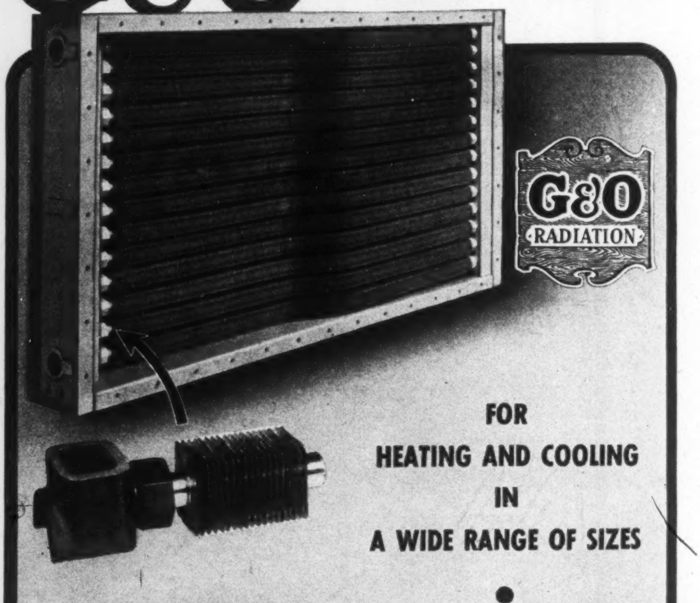
Air Conditioning as a Vocation

A 20 p. monograph on air conditioning as a vocation, by John T. Schaefer, air conditioning and commercial refrigeration department, General Electric Co., was recently published by the Bellman Publishing Co., Inc., 6 Park St., Boston, Mass. Price of the pamphlet is 50c.

According to the foreword, "now that air conditioning has attained its maturity as an important segment of our business structure, its opportunities can be evaluated with better clarity and reason than was possible a few years ago." This is the objective of the monograph.

There are sections on air conditioning as a growing

G&O COILS



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Detail of mechanical joint used in Universal Heat Transfer Coils.

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Pioneer Manufacturers of Square Finned Tubing in the United States

industry; its origins; technical development; definition of air conditioning; purposes; what it does for people; what it does for materials; industrial air conditioning and its market; commercial air conditioning and its market; air conditioning for residences; equipment; types of work available; compensation; qualifications; schools; professional publications; and bibliography.

Metals at Low Temperatures

A report on the properties of metals at subatmospheric temperatures, providing voluminous data on the impact resistance and tensile properties of metals at such temperatures, has resulted from two years' study by the joint ASME-ASTM research committee on effect of temperature on the properties of metals, the actual work being carried on by a subcommittee headed by Francis B. Foley. The information and data resulting from extensive circularization of laboratories known to be interested in low temperature were referred to Dr. H. W. Gillett at Battelle Memorial Institute who classified the data, added much material from literature, and supplied critical comments with the assistance of his associates, H. W. Russell, S. L. Hoyt and H. C. Cross. To make the publication more usable, a comprehensive bibliography was added and an index to the major topics covered in the volume is included.

Since the notable summary of available information by Russell in 1931, a great deal of data have been developed by producers and users of materials used at subatmospheric temperatures. Many of these data have been reviewed and are included in this report. Over 50 per cent of the material is in the form of 142 tables.

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have matched seats

—To give Unmatched Performance

One of the big reasons that Dart Unions make up tight the first time, quickly and **easily**—stay tight longer—and can be re-installed so many times is due to the **fact** that they have matched bronze seats, ground to accurate "true-ball" surfaces. **Another** big reason for the complete satisfaction that Dart Unions give is that their bodies and nuts are made of air refined malleable iron that resists pipe strains and wrench abuse.

Now—when pressure on production is so high and you need equipment that you can install easily and **forget about**—specify DART UNIONS. If you wish—and will just tell us size and model—we will gladly send you a Dart to try free.

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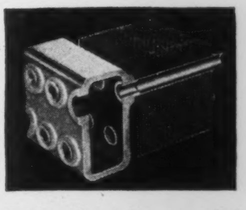
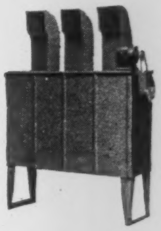


Copper alloy tubes are rolled (not brazed) into sturdy, cast alloyed iron headers—then reinforced with snug-fitting ferrules.



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NEW YOUNG VERTIFLOW UNIT HEATERS

Features:

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2. Insulated Shield protects motor against overheating during off-periods.
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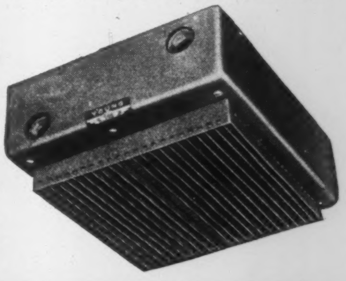

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HEATING COOLING AND
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Hank sez—

Here's An Emergency Boiler That Meets The Emergency

DON'T look so all worried up.
What's the matter?
Can't you get pry enuff on the priorities ter get the boiler what yer oughter had long ago, and ain't yet?

A big boiler, eh? Say one around a rating of from 4500 to 14,600 sq. ft. of radiation for steam, and 7200 to 23,360 for water?

Been holding up laying of floor waiting fur the boiler, eh?
What fur you been waiting, when there ain't no need ter?

Can it be, you ain't heard tell of this here Big Burnham Twin Section Boiler what can be slipped piece by piece thru any opening you can walk thru yourself, even when going side ways?

Where you been all summer anyway?
Well, let's quit calling names, fur here's the boiler what now has the call.

Our folks can ship it tomorrer if you order it terday.
But ain't making no promises if you wait fur day after tomorrer.
Won't, cause it's an emergency boiler what is sure getting called on fur meeting emergencies.

HANK

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Burnham Boiler

Following the discussion on impact resistance—which covers limitations, effect of testing variables, impact velocity and cooling technique (the impact test is an important means of evaluating low temperature properties of materials)—there is a section devoted to impact data for non-ferrous materials, followed by the most extensive portion of the publication covering ferrous materials of a wide range. Fifteen pages of the report relate to low temperature tensile properties.

Copies of this 112 p. publication in heavy board cover with wire ring binding are available from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa., at $2.50.

Sterilizing Air

One of the papers presented at the recent fiftieth anniversary celebration of the University of Chicago described a test at "The Cradle," an infant hospital in Evanston, Ill., which proved the value of sterilizing air by means of ultraviolet light. Twelve babies were placed in air conditioned cubicles; 12 more in air conditioned cubicles completely closed with room only for the nurse to reach her hands in to attend them; and 12 more were placed in air conditioned cubicles whose entrances were curtained with ultraviolet light.

In the two years before the experiment the 36 babies in the nursery had had 64 attacks of colds and similar infections. In two years of the new system there were counted only 17. Of the 17 the cubicles protected only by air conditioning produced 15, while those protected by ultraviolet or mechanical air barriers had one each.

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You'll WIN!!

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Let Key-Graphite Paste Help You Win Over Leaky Oil and High-Pressure Steam Connections.

When you use Key-Graphite Paste on all thread and gasket connections where hot or cold oily liquids, or high-pressure steam are involved, you have made them leakproof "from now on." Key Paste will save you time and money because it does the job right—the *first* time. It expands when heated and will *not* freeze the joint in service . . . preserves threads and gaskets and is economical to use because it goes several times farther than ordinary pipe dopes. Learn *all* the advantages of Key-Graphite Paste by trying it in service. Send for free sample.

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Book Reviews

Building Insulation

Paul D. Close, technical secretary of the Insulation Board Institute, and formerly technical secretary of the American Society of Heating and Ventilating Engineers, has written a book on Building Insulation which was published last month by the American Technical Society, Drexel Ave. at 58th St., Chicago, Ill. Comprising 328 pp., 5½ x 8¼ in. in size, clothbound, its price is $3.00.

It is intended to serve as a reference volume on the principles and application of heat and sound insulation for buildings, and should appeal not only to the architect, engineer and manufacturer, but also to insulation salesmen and users of insulation. It can also be used as a text. While concerned mainly with the application of insulation in residential buildings, larger structures are not neglected and much of the data are of a fundamental nature and therefore universally applicable.

There are chapters on thermal building insulations; methods of application; fundamentals of heat transfer through building materials; transmission coefficients and tables; calculating heat losses; effect of building insulation on heating plant size; fuel saving; economics of insulation; insulating efficiencies; expansion of roofs; condensation; insulation and comfort; pipe and duct insulation; sound insulation; machinery isolation; and architectural acoustics and noise quieting.

A useful feature is a comprehensive 13 p. listing of

LOTS of HEAT at LESS COST

FACTORIES
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COMMERCIAL BLDGS.

HERE'S the ideal method for heating factories and commercial buildings. Reznor Suspended Gas Fired Unit Heaters are RUGGED and provide trouble-free heat right where you want it. Very SPECIAL design of the heat exchanger tubes permits uniform distribution of warm air over extra wide areas. Boiler room and heavy maintenance expenses vanish with the use of gas. Intermittent firing reduces fuel costs. Reznor Line is complete. Write for Catalog U 42.

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"GAS HEATERS EXCLUSIVELY SINCE 1888"

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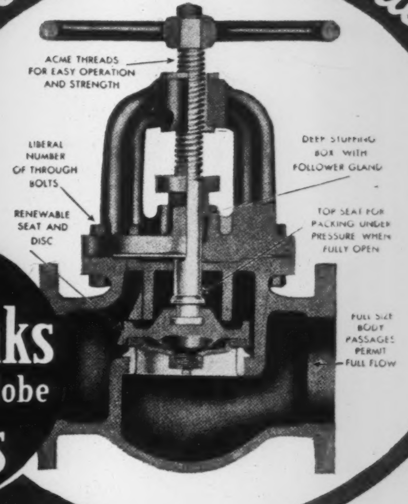
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TOP SEAT FOR PACKING UNDER PRESSURE WHEN FULLY OPEN
FULL SIZE BODY PASSAGES PERMIT FULL FLOW

Fairbanks
Iron Body Globe
Valves

Where else will your valve dollars buy such outstanding value as in this Fairbanks Iron Body Globe Valve?

Where else will you get valves made of a semi-steel of a tensile strength 66⅔% greater than ordinary cast iron . . . that have a seat and disc which can be renewed in a few minutes right on the pipe line . . . with back seating on spindle to permit repacking under pressure . . . with strong deep-cut threads . . . with guides in body to insure perfect seating of discs . . . bushed throughout to insure long, dependable service.

Only when you try one of these Fairbanks Valves will you believe that any valve could operate so easily, close so tightly and cost so little for maintenance.

Get a "close-up" of the biggest valve value by asking your Fairbanks distributor to compare this valve, part for part, with any other.

Write now for catalog No. 21.

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396 Lafayette St., New York, N. Y.

Valves, Dart Unions, Hand Trucks and Wheelbarrows

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NO-VE-U
VENTILATORS

for DOORS,
WALLS,
Partitions

Air conditioning men are finding more and more uses for this attractive "Venetian-type" ventilator.

Illustration shows sectional view of sight-proof louvres. Note how louvres are placed so that it is impossible to see through the NO-VE-U from any angle.

The removable frame makes installation in conventional doors quick and inexpensive, as no wood moulding is necessary. Ruggedly built of 17-gauge steel, the NO-VE-U will stand far more abuse than any ordinary grille.

Also available with adjustable louvres which may be opened or closed by a regulating lever on one side of the ventilator. Write today for full details on the NO-VE-U Ventilator and the complete line of practical Waterloo Air Diffusion Equipment.

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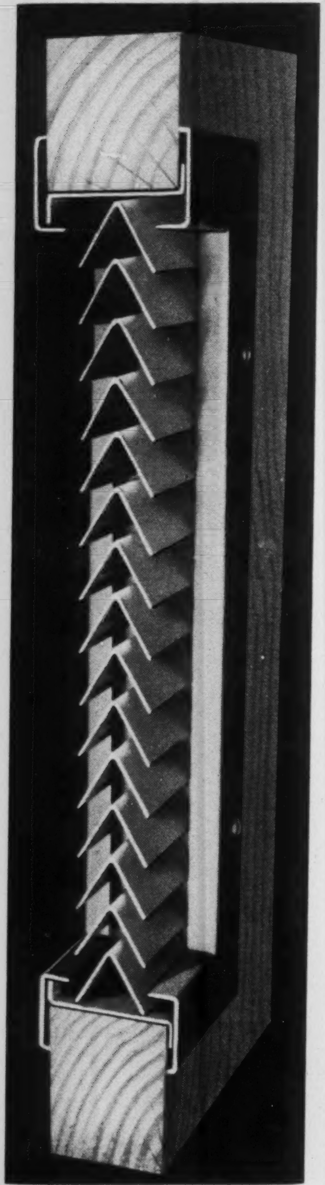


Waterloo
AIR DIFFUSION EQUIPMENT

commercial insulating materials according to their trade names, with a brief description of each and the name of the manufacturer or the distributor.

Story of Silicosis

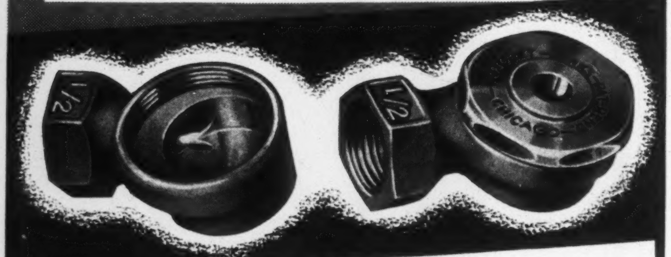
The John B. Pierce Foundation, New York City, has recently published a preliminary report on Pneumoconiosis (Silicosis)—the Story of Dusty Lungs. Prepared by Louis Gregory Cole and William Gregory Cole, it covers the subject of silicosis thoroughly, including history of dust inhaling, problems of pneumoconiosis, dust flecks and their careers, classification of type, social and economic aspects of the disease, etc.

Copies of this clothbound book are available to those interested, it is understood, by request on company letterhead to the John B. Pierce Foundation.

Flow of Water in Pipes and Pipe Fittings

A most unusual and elaborate volume has recently been published by the American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y. It is entitled Experiments Upon the Flow of Water in Pipes and Pipe Fittings, by John R. Freeman, and describes tests made by him in 1892. These experiments were not only fundamental in character but the most precise of any made up to that time. They have been published now, under the editorship of his son, because of their fundamental character and particularly because the results obtained yield much more information in the light of modern knowledge than was ever realized by Mr. Freeman himself. The original experiments included the introduction of artificial roughness in new commercial pipe and were of unusual extent.

THE PERFECT NOZZLE
FOR AIR CONDITIONING
...ROTOJET by BINKS



Rotojet breaks up the fluid into an ultra fine uniform spray. Specially designed for air conditioning, refrigeration and similar uses. Comes in a wide variety of sizes and capacities. Precision made of tough marine bronze. Also available in special alloys and stainless steel. **WRITE FOR BULLETIN 250,** which describes this and other BINKS spray nozzles.

BINKS MANUFACTURING COMPANY
3114 CARROLL AVENUE Dept. H440 CHICAGO, ILLINOIS

The text is very logically divided into seven parts, each of a semi-independent nature. A particularly noteworthy feature is the presentation of the results mainly in the form of plotted curves rather than "in algebraic formulas which the hurried or careless worker might use far beyond the limit of the experimental determination." The book comprises over 350 pages 9 x 11½ in. in size and is beautifully gotten up and substantially bound. The price of the book, which may be ordered from the ASME, is $8.00.

Mechanical Engineers' Handbook

The new fourth edition of the Mechanical Engineers' Handbook, edited by Lionel S. Marks, appeared recently. According to the publisher, there have been many additions and changes since the third edition was issued in 1930.

For instance, the new volume covers the new systematization of the theory of flow of compressible and non-compressible fluids, with special reference to flow of fluids in pipes; there is a completely rewritten section on heat with a convenient method for ascertaining the behavior of imperfect gases; there is a rewritten section on heat transmission, containing a condensation of the new knowledge on heat transfer; a new treatment of the subject of mixtures of gases and vapors, including the use of the sigma function, is presented; and there is a new and useful treatment of pipe line flexure stresses.

The fourth edition has 2274 pages, 4½ in. by 7 in. in size, contains over 1700 illustrations and 800 tables and is thumb indexed. Its price is $7.00; the publisher is the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York, N. Y.

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PECORA CALKING COMPOUND
for effective Air Conditioning

Temperature control in air conditioning is materially aided when calking is provided around all window and door frames, and when all building and air duct joints are sealed.

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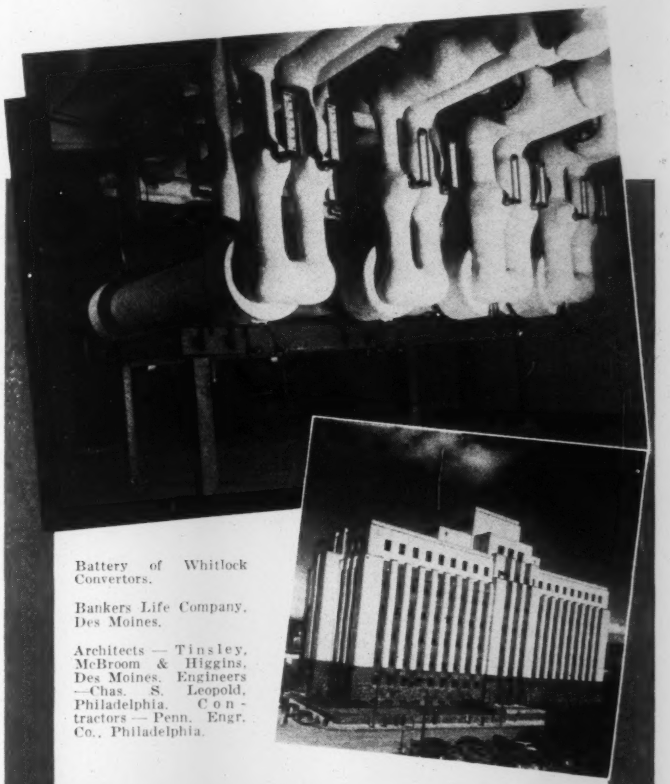

Battery of Whitlock Convertors.

Bankers Life Company, Des Moines.

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In a "Radiant" Heating System hot water, circulated through piping imbedded in the walls and ceilings, raises wall surface temperatures to above 100°—and occupants are comfortably warm at room temperatures considerably below normal.

Partial "radiant heating" or "wall warming" is performed at the Bankers Life Company's magnificent new home office through installation of piping around window areas with sufficient surface to offset the heat leakage through glass and walls.

To supply the hot water required, the battery of Whitlock Convertors illustrated was installed—also two Whitlock Water Chillers to supply chilled water for use in the same system during the summer.

Dependence upon Whitlock Heat Transfer Equipment is a habit of Engineers, Architects, and Contractors all over the country. Illustrated Bulletins available.

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44 South Street, Elmwood, Hartford, Conn.
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FILTER PANELS
are Specially Engineered
for Many and Diverse Uses

The AIR-MAZE panel is perhaps best known as a highly efficient, all-metal, permanent and cleanable air filter for Industrial and Residential Air Conditioning. However it has scores of other important uses for each of which the filter element is specially engineered. A few of these diverse uses follow:

AIR-MAZE for Industrial Ventilation

Many industries whose processes demand dust-free air for great precision and low cost production, as well as for health protection, depend on AIR-MAZE filter panels.

AIR-MAZE "Greastop" for Capturing Entrained Grease

Hotels and restaurants have found in AIR-MAZE "Greastop" panels the effective way to capture grease entrained in the air over kitchen ranges, thus preventing duct fires and protecting health.

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AIR-MAZE panels are used in Paint Spray Booths to prevent excess sprayed material from permeating exhausted air and thereby avoiding deposits outside on persons and buildings.

AIR-MAZE "Inkstop" for Catching Entrained Ink

In the printing industry ventilating devices equipped with AIR-MAZE "Inkstop" panels solve the problem of collecting entrained ink in the air during speed production work.

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Where entrained moisture in the air must be eliminated, as in evaporative condensers, some types of cooling equipment and certain industrial proceses, special AIR-MAZE filter panels effectively take care of the trouble.

AIR-MAZE for Coping with Entrained Oil

Entrained oil in the air of Oil Spray Booths, Machine Shops and Industrial Plants is often an annoying problem. AIR-MAZE filter panels provide the effective remedy.

Let Us Help You Solve Your Air Filtration Problems

AIR-MAZE CORPORATION
5200 HARVARD AVE. CLEVELAND, OHIO

AIR-MAZE
DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

Coming Events

Industrial Hygiene Foundation of America: Annual meeting, November 12-13 Mellon Institute, Pittsburgh, Pa. Headquarters office, 4400 Fifth Ave., Pittsburgh, Pa. The program is to revolve around the theme "Defend the Defense Worker!"

American Society of Refrigerating Engineers: Annual meeting, December 3-6, St. Louis, Mo. Headquarters office, 37 W. 39th St., New York, N. Y.

American Society of Heating and Ventilating Engineers: Annual meeting, January 26-30, Philadelphia, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y.

Seventh International Heating and Ventilating Exposition: January 26-30, Commercial Museum, Philadelphia, Pa. Under auspices American Society of Heating and Ventilating Engineers and under management International Exposition Co., Charles F. Roth, president, Grand Central Palace, New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-28, Hotel Schroeder, Milwaukee, Wis. George J. Stoehr is chairman of the local convention committee. Headquarters office, 1250 Sixth Ave., New York, N. Y.

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AN ORGANIZATION
EXPERIENCED IN THE
DESIGN AND MANUFACTURE OF
METAL PRODUCTS

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CIRCULAR STEEL SHAPES
MEDIUM AND HEAVY STAMPINGS
FABRICATED AND WELDED PARTS
TANK HEADS — TANK ACCESSORIES
STANDARD PARTS FOR HEATING AND AIR-CONDITIONING EQUIPMENT
STEEL PALLETS FOR THE CONCRETE BLOCK INDUSTRY
HYDRAULIC EQUIPMENT
PUMPS—VALVES—HOISTS
STEEL TUNNEL LINING

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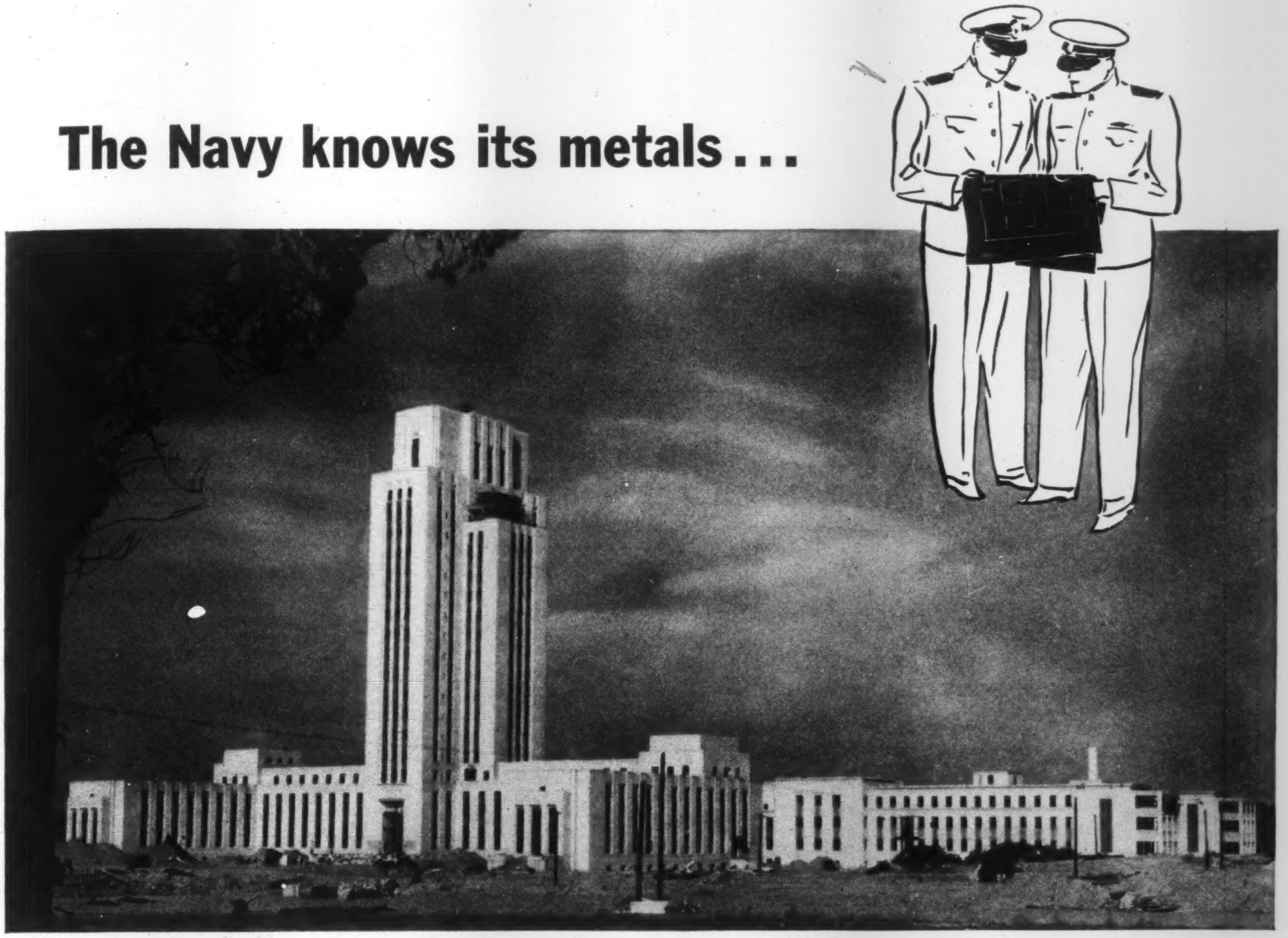
THE COMMERCIAL SHEARING & STAMPING CO.
YOUNGSTOWN, OHIO

The Navy knows its metals...



New Naval Hospital near Bethesda, Md. 100,000 pounds of Revere copper water tube and 50,000 pounds of Revere sheet copper protect this building inside and out. The consulting architect was Paul P. Cret and the general contractor was John McShain Inc. of Philadelphia, Pa. Plumbing and heating equipment were supplied by Standard Engineering Co. of Washington, D. C.

WHEN the Navy comes ashore, it brings along a knowledge of the rust-proof durability of Revere copper learned through the experience of American Naval history. The hull of the famous frigate "Constitution" was sheathed with Revere copper before the War of 1812. And today our warships have many of their vital parts made of copper and alloys of copper from Revere.

So, in the Navy's new Medical Center near Bethesda, Maryland, it is natural that Revere copper should be extensively used. More than 100,000 pounds of Revere copper water tube, and nearly 50,000 pounds of Revere sheet copper were used in the plumbing, heating and air conditioning systems.

Copper and copper-base alloys such as brass, bronze and Herculoy, made by Revere, bring rust-proof durability and high efficiency to heating, piping and air conditioning. Revere Technical Advisory Service is set up to help you with your problems. Write us.

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Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January, 1941, Heating, Piping and Air Conditioning and thus keep your records of sources of supply up to date throughout the year . . . Single asterisk (*) indicates equipment not listed in Directory Section; double asterisk (**) equipment and manufacturer not listed

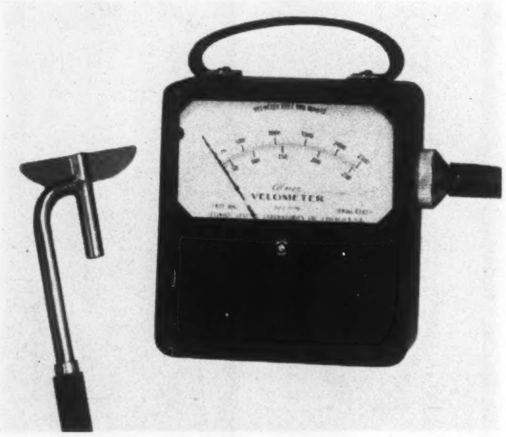
Plastic Tubing

No. 2197*—A flexible, semi-transparent tubing of thermoplastic "Saran" is available as an alternative for copper and other metal tubings, according to a recent announcement. Developed through years of research, this tough, chemically resistant tubing may be used in many applications previously demanding copper except where high temperatures and very high pressures are encountered. Also, it has been tested and proved suitable to replace such strategic materials as nickel and stainless steel in several fields where its unusual properties are advantageous, says the manufacturer.

This tubing is characterized by resistance to moisture, brines, solvents, acids and alkalies. Another feature is that it may be used for short periods of time at temperatures of 250 to 275 F, although its strength and resistance are somewhat reduced at these elevated temperatures. It is available in sizes of $\frac{1}{8}$ to $\frac{5}{16}$ in. outside diameter with wall thicknesses varying from 0.030 to 0.062 in., and may be joined by "Parker" standard tube couplings and SAE or other flare type fittings. The Mueller Brass Co. is developing fittings which permit the construction of a tubing system in which contact between such fittings and the material conveyed is entirely eliminated.—Dow Chemical Co., Midland, Mich.

Measuring Air Flow

No. 2198—A new intake or exhaust grille jet has been developed for the "Alnor Velometer" to enable its use for measuring air flow at intake or exhaust grilles. It is an attachment for these direct reading air velocity meters of the swinging vane type and can be added by the manufacturer to instruments now in use. The new jet is offered in two sizes, one for low velocities with full scale ranges of 0 to 1000 fpm, and the other for velocities with scale ranges from 0 to 2500 fpm and higher.



The problem of measuring air flow at intakes has been difficult because of the rapid change from static to velocity pressure at such points.

The new jet has two calibrated air intake openings, one of which is at the end of the main member. This member forms a compensating tube and extends from the grille face outward from or beyond the critical suction zone. At right angles to this main member is a calibrated branch tube to which is attached the flexible tube to the instrument. The air actuating the velocity meter movement is inspirated through this branch tube by the force of the suction exerted upon the main member or compensating tube.—Illinois Testing Laboratories, Inc., 420 N. LaSalle St., Chicago, Ill.

Unit Heater

No. 2199—A new unit heater, designed to provide quick, economical and thorough heating for industrial and many types of commercial buildings, is called the "Five-Way" because of its ability to discharge heat in five directions—outward four ways and downward.

For Your Convenience

Heating, Piping and Air Conditioning, [12-41]
6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in "Equipment Developments" and "Trade Literature."

(Circle each number in which you are interested)

2197	2198	2199	2200	2201	2202	2203	2204	2205	2206
2207	2208								
4040	4041	4042	4043	4044	4045	4046	4047	4048	4049
4050	4051	4052	4053	4054	4055	4056	4057	4058	4059
4060	4061	4062	4063	4064	4065	4066			

Name........................ Title..................

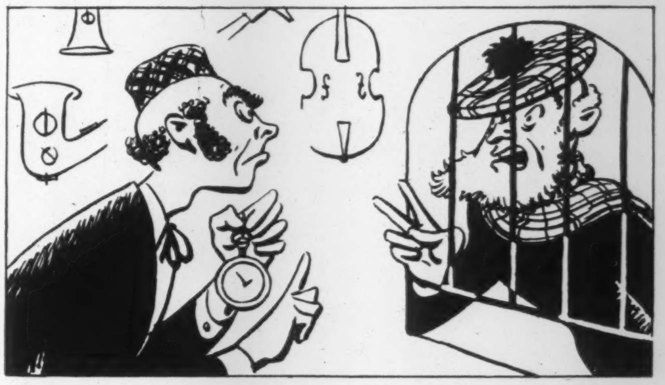
Company ....

Address ....

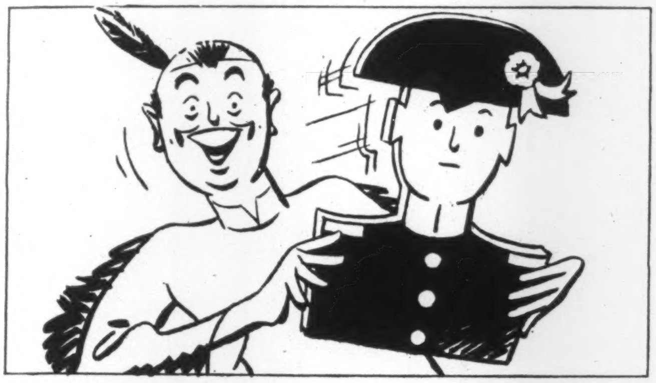
City........................... State..................

"For Central Systems, here's the filter for me, It keeps out dirt, keeps air dust-free." —Contributed by lyric Plant Mgr.

1. Because they're so efficient, you'll crown yourself "air filter king" a month after you change to Dust-Stops.* Capacity: 2 CFM per square inch of area at 300 FPM. Average resistance, new, in inches of water gauge; .062 for 1-inch, .13 for 2-inch.



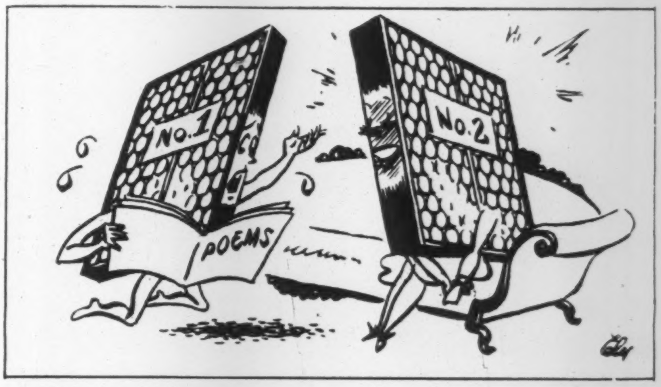
2. Speaking of economy, why Dust-Stops save money faster than a pawn-shop in Scotland! About 1 cent per CFM to install. Only about 1/10 cent per CFM, when filters need changing. Compare that cost, my friend, with other filters. Can you beat it?



3. And Dust-Stops are so easy to change that you'll think you're a lightning-change artist. No washing. No draining. No charging. No need to carry spares at any time. And no skilled labor required when Dust-Stops get dirty.

4. Are deliveries coming through? Yes, sir, Fiberglas Dust-Stops are being delivered. Just as promptly, as in normal times. Fiberglas, you know, is made from materials native to continental United States. And the supply is inexhaustible.

5. Ever say "Scat" to a cat? In less time than that, you can clean these sturdy filters if you want to. Vacuum clean them. Knock them gently on the side. Watch the dirt fall out. This cuts Dust-Stop's low maintenance costs even more—another economy plus for you.



6. Why not do the way the lyric Plant Manager has already done? Why not order your Dust-Stops today? Come in two thicknesses, No. 1 (1-inch), No. 2 (2-inch). From air-conditioning manufacturers, dealers, or jobbers. Or write us.

FIBERGLAS* DUSTOP* AIR FILTERS

*T.M. Reg. U. S. Pat. Off.

Made by Owens-Corning Fiberglas Corporation, Toledo, Ohio

DIRECT CANADIAN INQUIRIES TO FIBERGLAS CANADA LIMITED, OSHAWA, ONTARIO

AS AMENDED BY THE
HEATING TRADE:

PETRO
Cuts Steam Costs
"Service"-also

Some Heating Contractors have available service assistance for firing plants they install; some do not—

Both groups know service, when necessary, increases operation cost and the less service required the better the customer likes the installation as made.

Both groups also know what a wide gap can exist between equipment in a catalog (or specification) and that same equipment in a boiler.

The heating man's job is to bridge that gap, and whether he likes it or not—whether he does the servicing or not—any necessity for excessive service reflects on the contractor in the mind of the plant owner.

PETRO "DESIGNS IT *OUT*"

With Petro Systems, both contractor and plant owner are assured a remarkable freedom from service.

This is true regardless of whether the system was installed for manual operation with "cold" oil, or completely automatic operation with pre-heated oil, or any degree between.

Costly "cut and try" wastes in installation are eliminated with Petro.

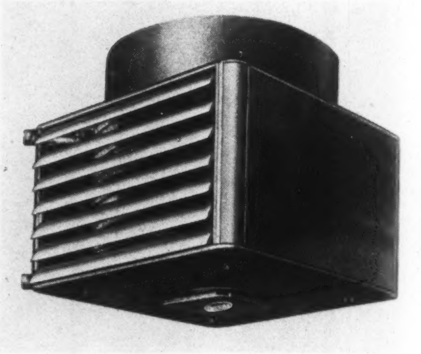
The burners are available in so wide a range that the contractor can select exactly the size and capacity needed. Petro's "lay-outs" and engineering suggestions are practical, economical, and efficiently complete. They are not "general" but apply specifically to the job in hand.

Added to the widely recognized excellence in Petro equipment, these things safeguard the contractor against having to put his profit in escrow to cover "second guess" costs for correction. They help him install a clean finished system which will deliver a firing operation that will add to his prestige.

FOR FURTHER INFORMATION
SEE OUR CATALOG IN SWEET'S

PETRO
OIL BURNING SYSTEMS

PETROLEUM HEAT AND POWER COMPANY
Makers of Good Oil Burning Equipment Since 1903
STAMFORD CONNECTICUT



Available with steam or hot water coils, the unit is of the suspension type, discharging the heated air out and downward for complete coverage of large floor areas. The direction of air discharge may be made at any angle by adjusting independently the louvers in the outlets. Though housed in the unit, the motor is in the entering cool air stream and is further protected from the heat of the coils by a circular shield.

Standard units have two outlets on opposite sides with the other two sides consisting of removable panels which may be replaced by outlets when desired. Louvers and panels may be interchanged even after installation. —Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.

Heat Exchangers

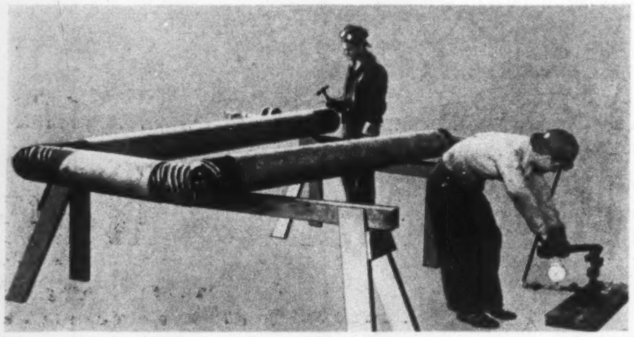
No. 2200—A separate division for the manufacture and design of heaters, coolers and condensers by a company engaged for many years in the fabrication of steel and alloy plate into tanks and other equipment for the process industries has recently been announced. The new division is being housed in its own building and is under the supervision of men having practical and technical experience in heat exchanger design and fabrication.

Products of the new division include storage water heaters, instantaneous heaters, "Freon" water coolers and condensers, large suction line heat exchangers for refrigeration, large drinking water coolers, etc.—Downingtown Iron Works, Heat Transfer Div., Wallace Ave., Downingtown, Pa.

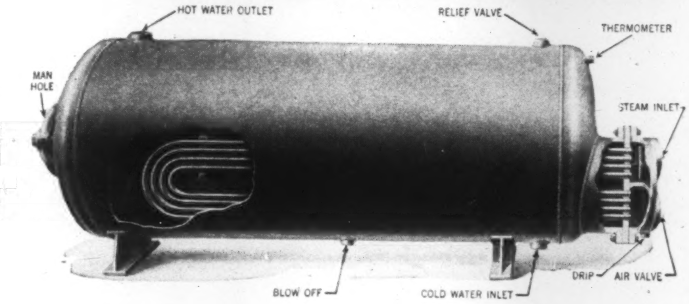
Expansion Loop Bends

No. 2201—Pictured below is a hydrostatic test of a U type expansion loop pipe unit. Water is sent by an intensifier pump into the looped pipe under a minimum pressure of 300 psi. The pipe is then heavily hammered at one end, which sets up a series of vibrations (oscillations) the entire length of the loop, causing further compression of water at each of the myriad points of vibration.

As may be noted from the picture, all welded portions of the steam pipe (at the loops) are left exposed until after the test. When the foreman finally passes the unit,



UNCONDITIONALLY GUARANTEED!



We admit that is a strong statement — and we'll back it to the limit. Installations of Patterson Hot Water Heaters, made according to our recommendations, will be unconditionally guaranteed to furnish all the hot water required for the purpose intended. And 60 years of experience in heat exchange engineering is in back of that guarantee!

Patterson Hot Water Heaters are tailor-made to fit the requirements of the particular installation or industry. They can be made in special alloys or metals, or copper-lined as the situation demands. And they are designed to give the maximum amount of hot water in the minimum length of time — all the hot water necessary for the specific job — delivered on time!

Patterson-Kelley engineers will be glad to discuss your hot water heater installation problems. No obligation, of course. Why not drop us a line today?

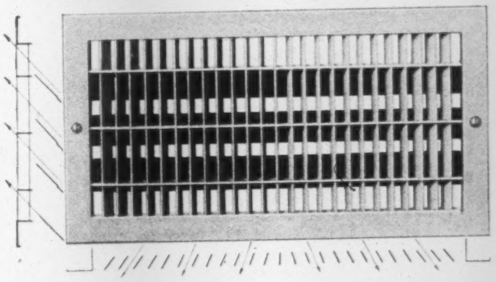
SPECIFY **PATTERSON** FOR DEPENDABLE, ECONOMICAL SERVICE

PATTERSON HOT WATER HEATERS

THE **Patterson-Kelley** CO., INC.
107 WARREN ST., E. STROUDSBURG, PA.

INDEPENDENT "Fabrikated" REG. U.S. PAT. OFF.

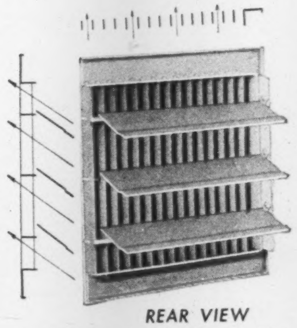
DIRECTED AIR FLOW GRILLES with Deflecting Vanes



No. 321A

Gives Compound Direction to Air Flows with Certainty

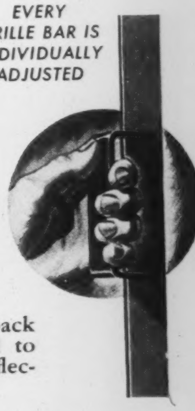
Each grille bar can be adjusted individually to direct air flow to the right, left or fanwise as illustrated. Adjustment can be made either before or after installing. Grille bars remain firmly in position without locking, and will not vibrate nor rattle.



REAR VIEW

Horizontal deflecting vanes in back may be individually adjusted to give upward or downward deflection to air flow.

EVERY GRILLE BAR IS INDIVIDUALLY ADJUSTED



Send for Catalog No. 41-AC

641

THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

the piping is sealed up into one complete unit by fitting together the end supports, completing the insulation at the bends, welding the "Armco Hel-Cor" where the miter has been cut at the bends, and then finally covering the U bends with hot asphalt coating and the same quality 30 lb asphalt saturated, asbestos felt and protective reinforced kraft paper that is shown on the balance of the expansion loop unit.—Ric-wiL Co., 1563 Union Trust Bldg., Cleveland, Ohio.

Chemical Products

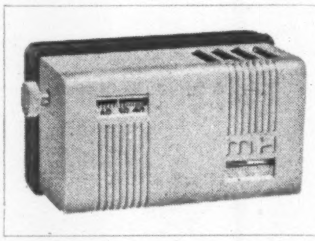
No. 2202—Among the new products recently announced by a manufacturer of building maintenance supplies are a fuel oil sludge solvent, a boiler and heating system cleaner, and a storage tank cleaner.

The fuel oil sludge solvent is poured into the storage tank, mixes with the fuel oil and keeps the sludge in suspension. In this way, according to the manufacturer, it prevents sludge accumulation, protects fuel tanks from inside rust, improves combustion and prevents soot.

The boiler and heating system cleaner is said to remove rust, scale, grease and solids which cause foaming and priming. The storage tank cleaner comes in concentrated powder form and is designed to eliminate rusty and discolored water.—Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.

Thermostats

No. 2203—Two new thermostats of horizontal design are available in two types, one for heating applications and the other for heating and/or cooling. They have been purposely designed for use where accurate and dependable control of line voltage, heavy duty devices are involved and are capable of handling directly large motor driven units, fans, blowers, cooling equipment, industrial and commercial stoker fired heating plants, etc., the manufacturer says. On larger or polyphase motors they should be used in connection with magnetic starters. Where desired, of course, they can be used in low voltage circuits.



The horizontal design provides maximum air circulation and greatly reduces the effect of contact heat, it is stated. The new "M-H Con-Tac-Tor" snap switch provides the switching action. This is a non-magnetic switch, self enclosed to protect it from dirt, dust, moisture and grime. Another feature is the temperature setting knob which can be removed to lock the thermostat in order to prevent unauthorized tampering.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.

High Pressure Relief Valve

No. 2204—The "Ashcroft" power control valve for high pressure installation from 1800 to 2500 psi is an automatic relief valve that may be set for a 1 per cent or less difference between opening and closing pressure, the manufacturer states. The immediate results are more accurately balanced boiler operation at peak loads and more uniform line pressure; in addition, its use reduces safety valve maintenance expense, it is said. The power control valve is set to open at a slightly lower pressure

Dramatic Proof

OF DEPENDABILITY

BY THE BAKER

"Foreign Legion" *

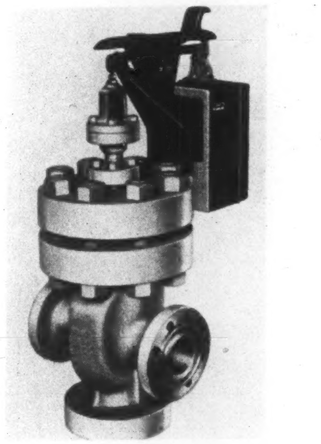
IN the far corners of the earth, where service on commercial air conditioning equipment is often a matter of days or weeks instead of simply picking up the phone and having the service man come over, dependable, trouble-free performance over long periods of time is of primary importance. The fact that more than one-eighth of all BAKER air conditioning machines go abroad is striking proof of their high quality and exceptional dependability.

Present conditions make freedom from frequent shutdowns, repairs, and adjustments more important than ever before, in *this* country as well as abroad. Make *your* air conditioning completely dependable by making it BAKER air conditioning. Write for details.

BAKER
SINCE 1905
ENDURING QUALITY
*
133 OUT OF EVERY
1000 BAKER MACHINES
GO ABROAD

BAKER ICE MACHINE CO., INC.
1508 EVANS ST., OMAHA, NEBR... SALES AND SERVICE IN PRINCIPAL CITIES
AUTHORITY ON MECHANICAL COOLING FOR 35 YEARS

than any of the safety valves, making it possible to continue a more even rate of steaming with a more uniform line pressure.



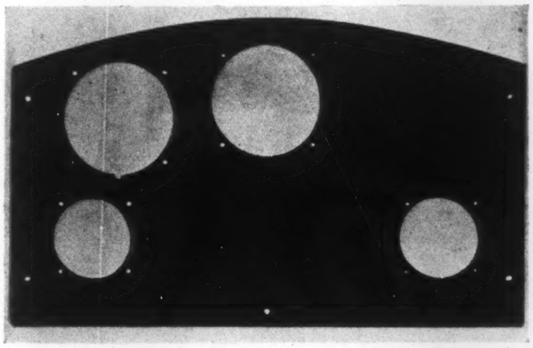
The principle of operation is simple. The boiler drum or superheater outlet pressure or steam header pressure actuates a pressure control set at the popping pressure, which operates an electric contact on a difference in pressure of 1 per cent or less. The electric current is transmitted to a solenoid which opens and closes the pilot valve. When it opens it unbalances the pressure over the main valve disc and it opens and remains open until the pilot valve is closed.

The unit is not intended to replace the spring loaded safety valve, but rather it is a supplementary operating valve, designed to conserve power and increase the efficiency of the steam generating plant.—Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

Plywood Instrument Panel

No. 2205—Illustrated here is an instrument panel of a type which was recently supplied in quantities to a leading manufacturer.

Fabricated from 1/8 in. three-ply birch "Ply-Tech" plywood, it has a dull black lacquer finish and was supplied ready for installation, with holes all made. In appearance, it closely resembles a bakelite panel.



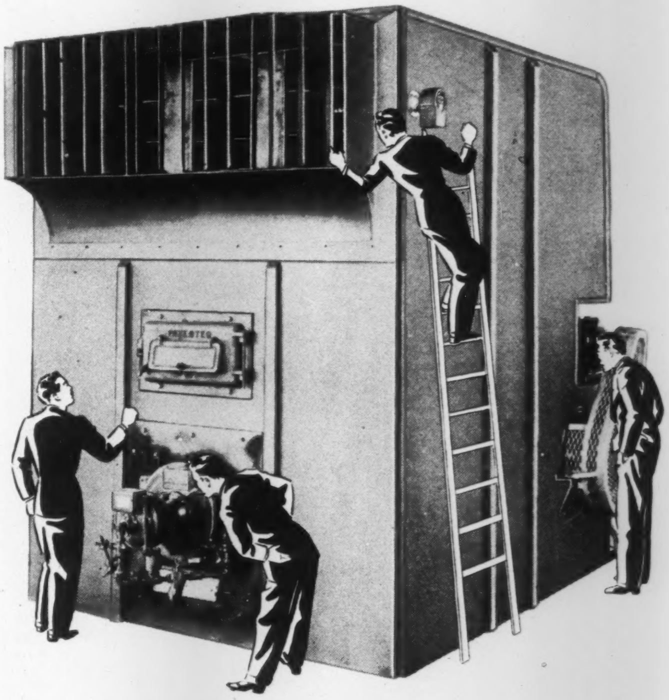
Such an instrument panel has the advantage of being able to be made without high initial die costs, says the maker, who states that it is sturdy and will not chip easily.—Technical Ply-Woods, 228 N. La Salle St., Chicago, Ill.

Cleaning Air Conditioning Systems

No. 2206**—A method of cleaning and dustproofing air conditioning equipment was announced last month. It is a chemical process for cleaning the ducts, fans, coils, filters, controls, louvers, etc.

A single treatment by factory trained service men can be applied without interruption to business and without muss or fuss, says the manufacturer, to eliminate and prevent clogging and accumulation of dirt. — Speed-D Chemical Systems, 622 Broadway, Cincinnati, Ohio.

The closer you look
The better you'll like it:



DIRECTHERM
HEATER

the direct-fired Unit Heater in 6 sizes (300,000 - 1,700,000 BTU) for plant, office, and shop.

It is a real fuel saver. Whether you burn oil, gas, or coal—it produces about 80% of the invested fuel energy and distributes it evenly up to 200 feet distance. That's heating efficiency!

The Directherm Heater is built to keep your cost down. The first cost is low, the installation simple, and the up-keep negligible, due to the sturdy construction.

Start your saving program today by writing for our bulletin 305 Z. It tells you the whole story.

AIRTHERM
MANUFACTURING COMPANY
711 S. SPRING AVE. ST. LOUIS, MO.

Insulating Cement

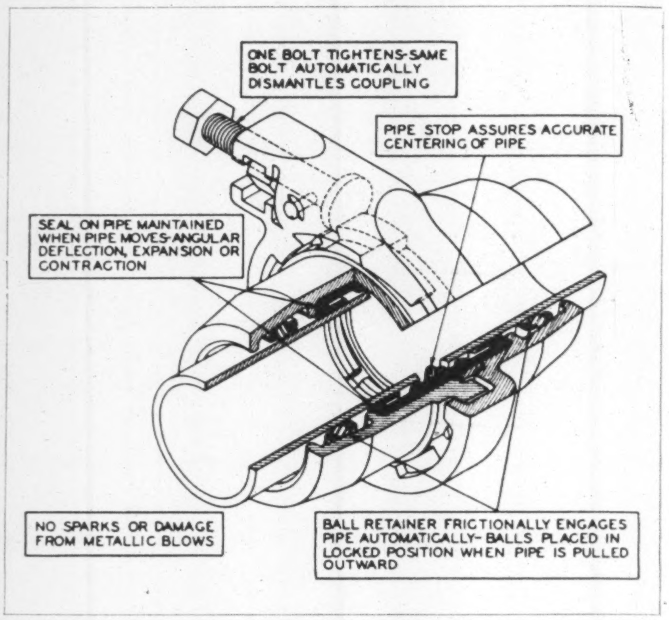
No. 2207—An improvement made recently in "B-H No. 1" insulating cement comprises an addition of a rust inhibitor to the formula. This prevents any corrosion taking place between the metallic surface and the cement, according to the manufacturer.

This cement is effective up to 1800 F and when used on equipment that operates at temperatures no higher than 1200 F, it is 100 per cent reclaimable, states the maker. It is adaptable for use on boilers, drums, walls, ducts, valves, flanges, breechings and similar hot equipment, and forms a continuous blanket of jointless insulation which strengthens considerably upon drying.—Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J.

Couplings for Plain End Pipe

No. 2208**—A new type ball grip coupling for high pressures as well as vacuum permits flexibility at the joint and simplicity in making a connection or disconnecting, the maker states. There is also provision for expansion, contraction and angular deflection of 7 deg at each end of the coupling.

The coupling consists of a housing with a ball retainer and a flexible sealing gasket. The ball retainer or cage carries a plurality of balls and a frictionally engaging means, so that after the pipe is inserted and pulled outward the balls are brought into contact with the tapered surface, causing a positive lock and preventing the pipe from being withdrawn. One bolt tightens the connection and the same bolt reversed automatically allows the coupling to be dismantled. No special tools are required.


ONE BOLT TIGHTENS-SAME BOLT AUTOMATICALLY DISMANTLES COUPLING
PIPE STOP ASSURES ACCURATE CENTERING OF PIPE
SEAL ON PIPE MAINTAINED WHEN PIPE MOVES-ANGULAR DEFLECTION, EXPANSION OR CONTRACTION
NO SPARKS OR DAMAGE FROM METALLIC BLOWS
BALL RETAINER FRICTIONALLY ENGAGES PIPE AUTOMATICALLY- BALLS PLACED IN LOCKED POSITION WHEN PIPE IS PULLED OUTWARD

This coupling has been developed for piping which must be dis-assembled for cleaning or other reasons. It also offers advantages wherever piping is used by providing fast emergency installation of permanent or semi-permanent pipe lines for use with any kind of fluid. In temporary or semi-permanent lines, thin light wall pipe can be safely connected, making a flexible pipe line, saving material and work of especially preparing the pipe ends, says the manufacturer.—Hanlon-Waters, Inc., National Bank of Tulsa Bldg., Tulsa, Okla.

BY THE MAKERS OF UNI-FLO GRILLES AND REGISTERS

venturi-flo

AIR DIFFUSER

RECESSED MODEL

- Deflector form of ceiling member minimizes streaking by giving the air stream a slight downward direction.
- Overall diameter is approximately 1/3 smaller than other models. For example, 10" throat size is 20" overall.
- Modification in design results in lower pressure drop through the diffuser.
- A wider range of sizes is now available.

NEW!

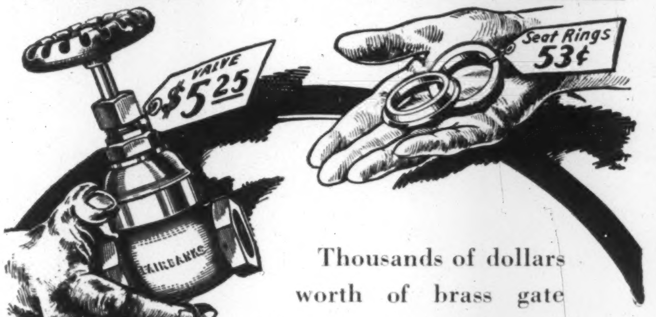
BARBER B-C COLMAN

For specifications of all UNI-FLO and VENTURI-FLO units, write for descriptive literature. Complete data also in SWEET'S CATALOG FILE (Architectural).

1228 ROCK ST. BARBER-COLMAN COMPANY ROCKFORD, ILL.

Which Would You Rather Buy ?

A New Valve — or — Renewable Seats



Thousands of dollars worth of brass gate valves are consigned to the scrap heap every year when they are as good as new except for a leaky seat. But it's different with Fairbanks *Renewable* Valves. They eliminate that waste.

Instead of throwing away a Fairbanks "Renewable" Bronze Gate Valve when the seat rings finally become worn, you can quickly slip in new ones—and the valve is as good as new at about 10% of what a new valve would cost. This takes only a few minutes—just long enough to unscrew the bonnet and slip in a new ring. And that can be done without removing the valve from the pipe line.

Contrast this quick, easy and inexpensive renewal with non-renewable valves that have the seats cast integral with the body.

Quick renewal is important when shutting off the steam for a long time means the shutdown of machinery for the same period.

Our valve book No. 21 contains some facts that will interest you. Write for a copy and the name of our nearest distributor.

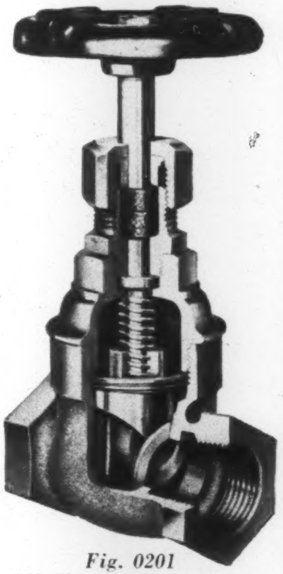
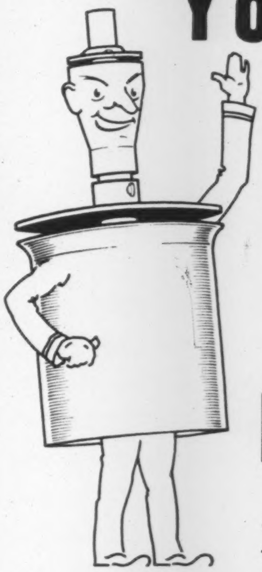


Fig. 0201
150 lbs. steam pressure

THE FAIRBANKS COMPANY
396 Lafayette St., New York, N. Y.
Valves, Dart Unions, Hand Trucks and Wheelbarrows
Boston, Mass., Pittsburgh, Pa.
Factories: Binghamton, N. Y., Rome, Ga.

Fairbanks Renewable Valves



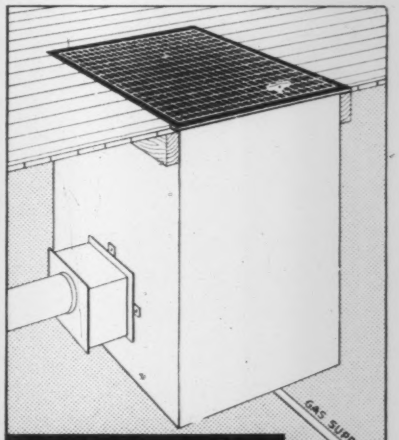
"You Can't Beat a JOHN ZINK FLOOR FURNACE"

As you would expect this furnace features a larger, improved Combustion Chamber and a One-port Non-plugging Gas Burner.

Immediate shipment from stock of either manual or automatic controlled floor furnaces.

FEATURE—Rapid Air Circulation, Quiet Operation, Uniform Heat Distribution through Register, and Durability.

SIZES — The John Zink Floor Furnace is built in three sizes — the input ratings are 25,000 B.t.u., 50,000 B.t.u. and 68,000 B.t.u.



That Amazing JOHN ZINK FLOOR FURNACE

The One Port Floor Furnace

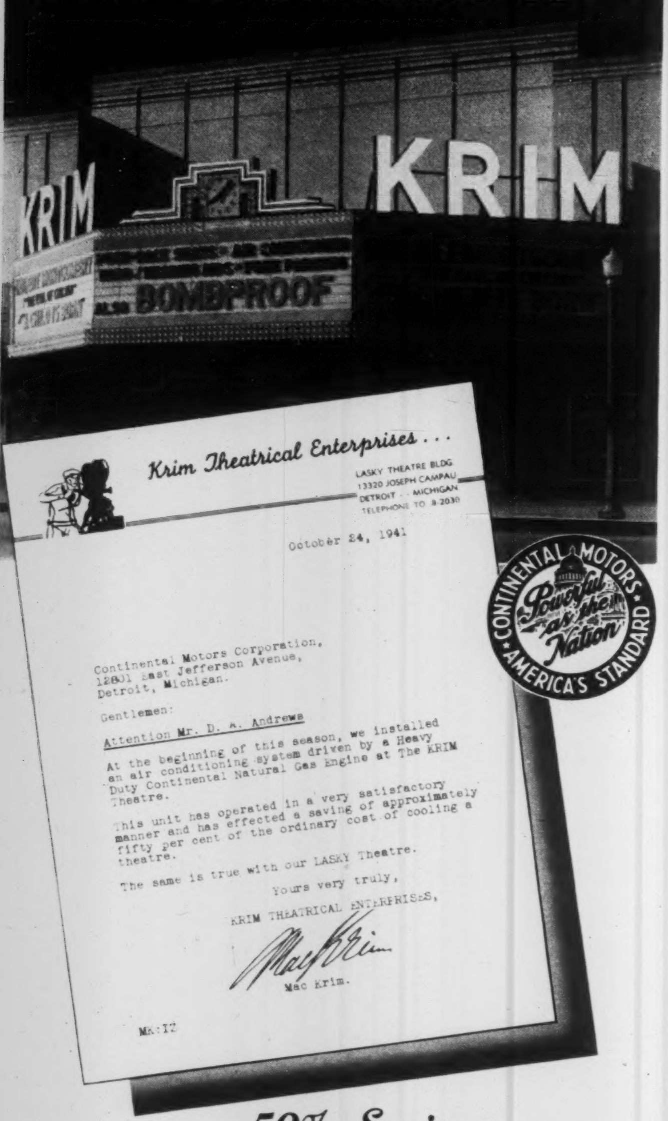
●

UNIT HEATERS for Commercial and Industrial Space Heating

●

John Zink Company
TULSA, OKLA.—4401 S. PEORIA AVE.
Chicago, Ill.—7309 E. End
New York City—342 Madison Ave.
Houston, Texas—5634 Lawndale

HERE'S PROOF OF REAL *Economy* IN AIR CONDITIONING COSTS



Krim Theatrical Enterprises . . .

LASKY THEATRE BLDG
13320 JOSEPH CAMPAU
DETROIT . . MICHIGAN
TELEPHONE TO 8-2030

October 24, 1941

Continental Motors Corporation,
12801 East Jefferson Avenue,
Detroit, Michigan.

Gentlemen:

Attention Mr. D. A. Andrews

At the beginning of this season, we installed an air conditioning system driven by a Heavy Duty Continental Natural Gas Engine at The KRIM Theatre.

This unit has operated in a very satisfactory manner and has effected a saving of approximately fifty per cent of the ordinary cost of cooling a theatre.

The same is true with our LASKY Theatre.

Yours very truly,

KRIM THEATRICAL ENTERPRISES,

Mac Krim

Mac Krim.

MK:IZ

50% Savings

The Krim and Lasky theaters in Detroit have cut operating costs on air-conditioning equipment 50 per cent by installing Continental Red Seal Engines to drive compressors.

These famous engines using natural gas for fuel are also giving complete satisfaction in hotels, apartment houses, restaurants, and office buildings.

Continental engineers are always ready to advise and help you on installation plans. Make use of their knowledge and cut operating costs.

Continental Motors Corporation
MUSKEGON, MICHIGAN

Book Reviews

Air and Gas Compression

Air and Gas Compression, by Thomas T. Gill, of the Union Oil Co. of Calif., assembles in one place a considerable variety of information concerned with the compression and transmission of high pressure air and gas. Of particular interest to the refrigerating engineer is the great amount of material devoted to compressors and their characteristics. Although compressors are discussed primarily from the viewpoint of air and gas compression, much of the material is applicable to refrigerating compressors.

In addition, the book contains data and information for computing the compression of actual gases by means of the so-called deviation factors which are, in reality, correction factors applied to computations involving the perfect gas laws. This material is of considerable interest because few gases exactly follow the perfect gas laws —all gases deviate to some extent. The methods of using these deviation factors to correct computations made by means of the perfect gas laws are explained in detail.

The book also presents material on the flow of gas in pipe lines, based on the Weymouth formula. Although this formula is still widely used in the gas industry, considerable use is beginning to be made of the new method of computations using Reynolds numbers which are not covered in this book.

In the back of the book will be found a number of alignment charts and useful tables for solving various formulas. The charts, which are clearly drawn, and the tables should save considerable time for those who make actual computations.

The book comprises some 180 pp., 6 in. by 9 in., and is clothbound. The price is $3.00 per copy, and the publisher is John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y.

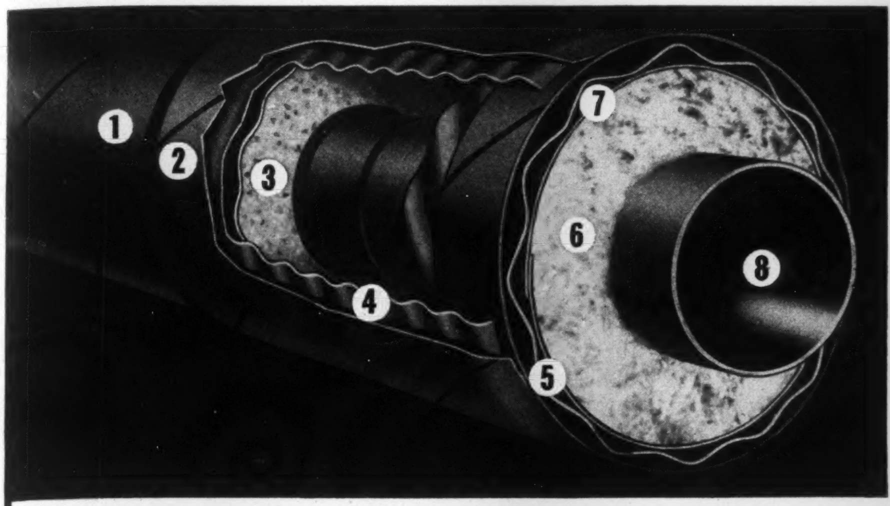
Useful Information

Rating and Testing Evaporative Condensers

The joint committee on rating commercial refrigerating equipment sponsored by the American Society of Refrigerating Engineers issued recently ASRE circular No. 20 presenting proposed standard methods of rating and testing evaporative condensers. This code is being presented for adoption to the membership of the society at its annual meeting in St. Louis and copies are available from the ASRE, 50 W. 40th St., New York, N. Y., for 20c.

Compressed Air Trade Standards

In 1938 the Compressed Air Institute, 90 West St., New York, N. Y., issued the fifth edition of its trade standards. These standards contain technical information on rotary compressors and vacuum pumps, centri-



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1. ASBESTOS FELT OVER ASPHALT COATED HEL-COR INGOT IRON
2. THICK STRIP ASPHALT APPLIED AFTER WELDING
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PRE-SEALED INSULATED PIPE UNITS

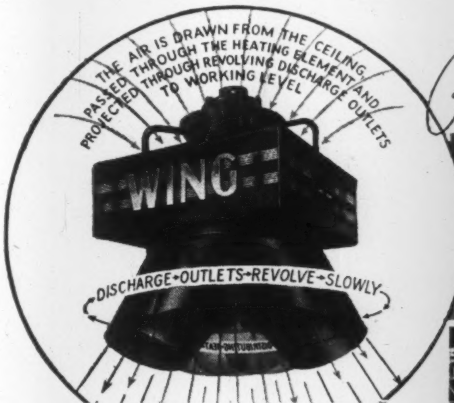
● The factory pre-fabricated system, completely engineered for modern demands on underground distribution of steam, hot water, and oil ● High thermal efficiency, long life, low installation cost ● Each unit shipped complete as shown, in 20-ft. units, or as required ● All fittings and accessories included ● Units are joined by split coupling or by welding ● Insulation can be any type specified by you ● Prompt shipment—speedy installation—nothing else to buy ● Bulletin on request.

THE RIC-WIL COMPANY CLEVELAND, OHIO
Agents in Principal Cities

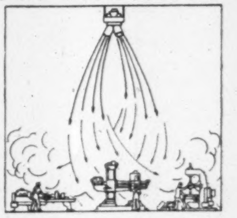
A New, Logical Method of Heating Industrial Buildings that is Setting New Standards of Comfort in Working Conditions

The gentle air motion created by the constantly changing direction of a WING Revolving Unit Heater brings a sensation of fresh, live, invigorating warmth to workmen, increasing their sense of comfort and promoting health and efficiency.

A prominent architect says: "WING Revolving Unit Heaters would be worth installing if they cost TWICE AS MUCH!" But they don't! In most cases they cost less. A new, complete catalog, Bulletin HR-1 is available. Write for your copy.



THE AIR IS DRAWN FROM THE CEILING, PASSED THROUGH THE HEATING ELEMENT AND PROJECTED THROUGH REVOLVING DISCHARGE OUTLETS TO WORKING LEVEL
WING
DISCHARGE•OUTLETS•REVOLVE•SLOWLY



The area covered by a WING Revolving Unit Heater is slowly swept by the heated air discharged by the outlets which move through 360° successively in every direction.

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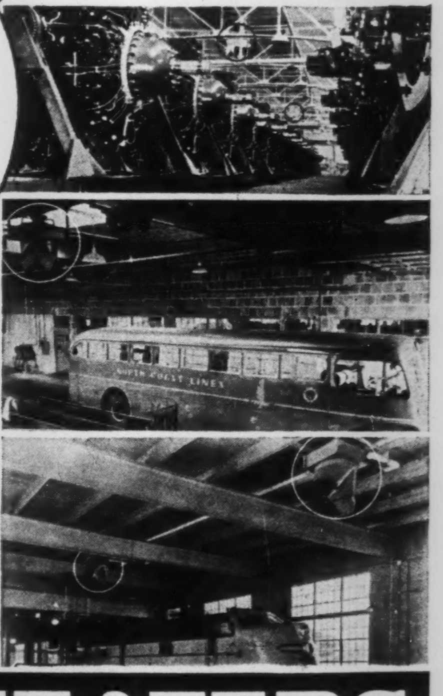


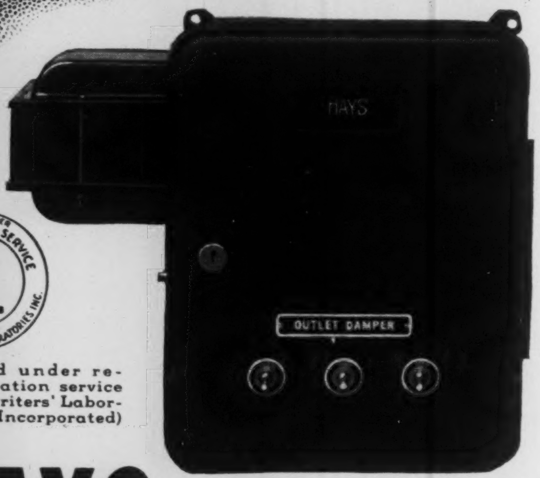
L. J. WING MFG. CO., 14th St. and 7th Ave., **New York, N. Y.**

WING *Revolving* UNIT HEATERS

UNIT HEATERS • VENTILATING FANS • EXHAUSTERS • BLOWERS • TURBINES

Provides **Efficient Draft**

during "OFF" as well as "ON" periods in intermittent firing—POSITIVELY PREVENTS BLOW BACK!



(Listed under re-examination service Underwriters' Laboratories Incorporated)

HAYS *automatic sequence*
FURNACE DRAFT CONTROLLER

AN ingenious and practical device for automatically controlling combustion in the "on" and "off" type of installation—burning either oil or coal. In wide use in apartment houses, small industrials, commercial installations, green houses, etc. **With this controller the firing equipment cannot start until the stack damper is wide open.** This allows for internal expansion without starting puff when fire lights. In operation, the combustion chamber draft is regulated to a low and efficient value during the "off" period and at an efficient and economical value during the "on" period. You'll win friends and influence sales with the Hays Sequence Controller—a definite economy and safety factor.

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SINCE 1901
COMBUSTION INSTRUMENTS AND CONTROL
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fugal compressors and blowers, reciprocating compressors, compressor accessories, rock drills and pneumatic tools, etc.

Because of the concentrated national defense efforts at the present time the institute has asked HPAC to bring these standards to the attention of its readers. Copies of the standards may be obtained at $1.00 per copy from the Compressed Air Institute.

Safety in Electroplating Operations

Another American standard in the industrial hygiene field became available for use by industry through the recent approval by the ASA of the American Standard for Safety in Electroplating Operations (Z9.1-1941). Copies are available from the American Standards Association, 29 W. 39th St., New York, N. Y., for 30c.

One section of the new standard gives specifications for exhaust systems and includes subsections on ventilation requirements, criterion for an exhaust system, duct system, air cleaning device, source of suction, and discharge stack. This section on exhaust systems sets up the criterion for safety that an exhaust system shall be so constructed and operated that the concentration of toxic materials in the air inhaled by the operators shall not constitute a health hazard.

Defense Handbooks

Two defense handbooks, one summarizing all price and priority regulations to date and the other listing every product subject to export control, have been published by the New York Journal of Commerce. Government and voluntary price controls and priorities are brought up to date in the price and priority digest. The export control list embraces 32 pp. of product listings with licensing and destination symbols posted next to each item. Both supplements have been published in tabloid form and may be had at 10c each from the Journal of Commerce, 63 Park Row, New York, N. Y.

Condensation in Buildings

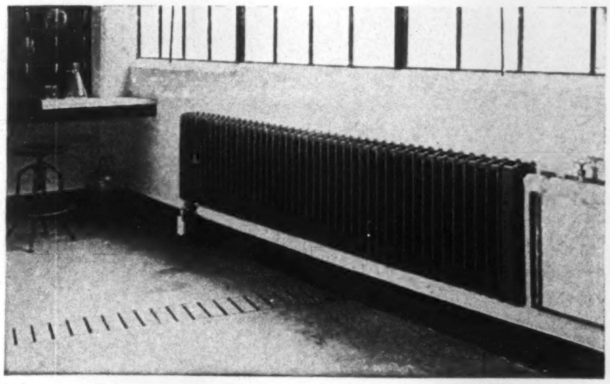
A 70 p. bulletin (No. 18) on Condensation of Moisture and Its Relation to Building Construction and Operation has been published by the Engineering Experiment Station of the University of Minnesota, Minneapolis. Copies are available from the university at 40c each.

The bulletin presents the complete results of three years of intensive work, which was financed to the extent of over $50,000 by the National Mineral Wool Association. The work was conducted by Frank B. Rowley, professor of mechanical engineering, Axel B. Algren, assistant professor of mechanical engineering, and Clarence E. Lund, mechanical engineer.

The bulletin is devoted mainly to residences, but includes a great deal of information pertinent to other types of buildings as well. In the conclusions it is pointed out that condensation on inner surfaces of walls usually can be eliminated by adding sufficient insulation to raise the room surface temperature above the dew point temperature of the room air. Window surface con-

DURABLE

Substantial construction assures long life!



SHAW-PERKINS HEATING UNITS

When you specify and install Shaw-Perkins radiators, you automatically guarantee long years of highly satisfactory heating performance. The substantial steel construction, with the heating element enclosed in a heavy corrosion-resistant tube, is full proof of the durability of Shaw-Perkins radiators—and the attractive, conservative styling is insurance against obsolete appearance later on.

The elimination of the possibility of annoying and expensive service calls means you'll enjoy your full margin of profit and gain the confidence and recommendations of your customers. Why not acquaint yourself today with the modern Shaw-Perkins line? Full information gladly sent on request.

MODERN RADIATION
SHAW-PERKINS
CONVECTOR RADIATORS

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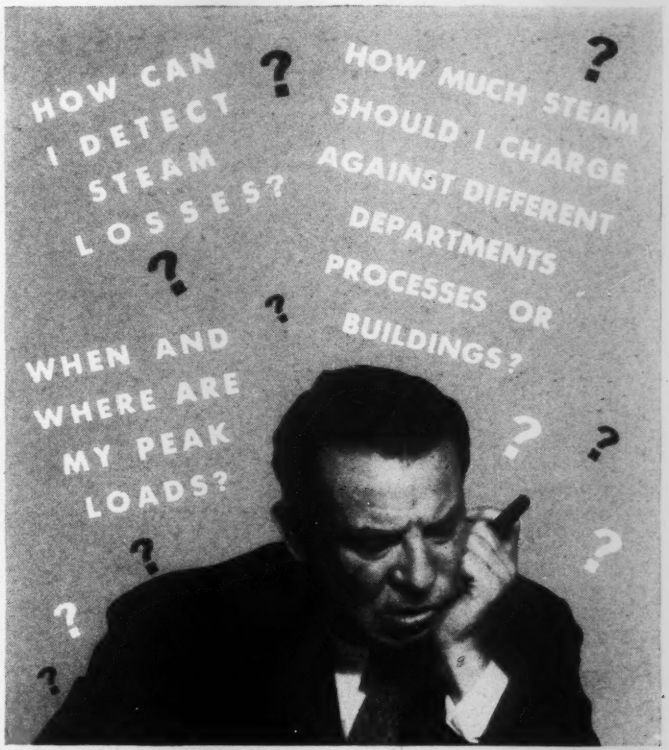

HOW CAN I DETECT STEAM LOSSES?
HOW MUCH STEAM SHOULD I CHARGE AGAINST DIFFERENT DEPARTMENTS PROCESSES OR BUILDINGS?
WHEN AND WHERE ARE MY PEAK LOADS?

LET ADSCO ROTARY CONDENSATION METERS

Give You The Answer

How can you arrive at accurate steam costs for separate buildings, departments or processes? . . . How can you stop steam losses unless you know where they are?

You can have this information and it won't cost you a fortune to get it. Simply install ADSCO Rotary Condensation Meters. These low cost meters are quickly installed and easily maintained. Their accuracy (factory tested within 1%) has made them the standard for leading industrial plants, colleges and district heating companies.

Tell us the maximum pounds of condensate per hour or the square feet of equivalent direct radiation in the building or department to be metered and we will tell you how surprisingly little it will cost to put your steam consumption on a sound accounting basis. Also ask for Bulletin 35-80HP.

Available in seven sizes 250-12,000 lbs. per hour capacity.

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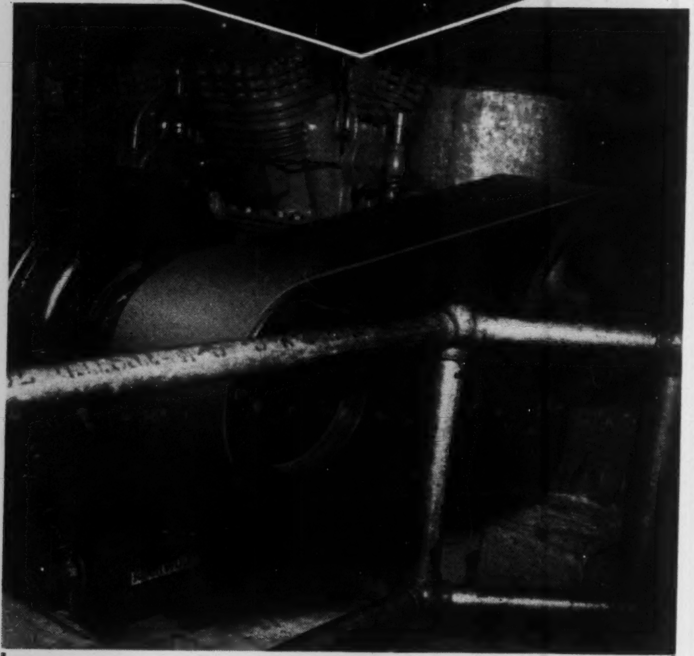

They Keep Air-Conditioning Operating Costs Down, Too

Dependable and efficient. That is why a number of air conditioning systems rely on Tannate-Rockwood pivoted motor base drives. The Tannate-Rockwood drive—*your motor equipped with a Tannate leather belt and mounted on a Rockwood pivoted motor base*—automatically maintains correct belt tension. Maintenance costs are negligible and operating costs are kept down. Write for details of the drive that is as modern as air conditioning.

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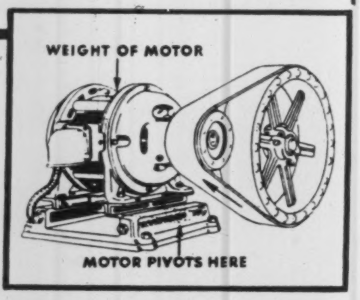


THE IDEAL SHORT CENTER DRIVE

densation may often be eliminated by the use of more than one thickness of glass with air space between different panes. In many cases, however, the most practical solution of surface condensation problems is to reduce the relative humidity of the inside air, the authors state.

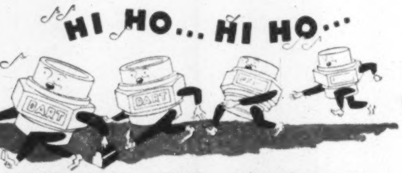
A good vapor barrier properly installed is the best insurance against condensation difficulties, according to the bulletin. A vapor barrier should be applied as nearly as possible to the warm surface of the wall, should cover the complete surface, and should be sealed properly around window and door openings, electrical outlets, etc.

Smoke Abatement Manual

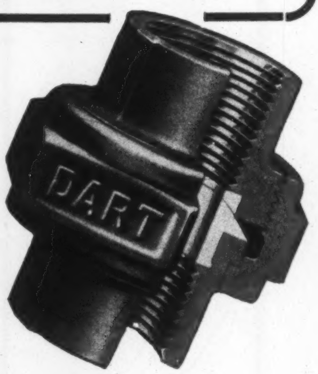
The new edition of the Smoke Prevention Association's yearly Manual of Ordinances and Requirements was issued last month; it is published in the interests of air pollution, smoke elimination and fuel combustion and includes the papers read before the 35th annual convention of the SPA as well as descriptions of methods of measuring air pollution.

There is also the model smoke abatement ordinance which has been adopted by the association and a summary of answers to a questionnaire on smoke prevention pertaining to smoke ordinance regulations in effect in cities throughout the United States and Canada.

Copies of this 176 p., 6 in. by 9 in. paper bound manual may be obtained for 60c each from the Smoke Prevention Association of America, Inc., 139 N. Clark St., Chicago, Ill.



—BACK TO WORK
THESE USED DARTS GO...



When you call on manufacturers, suggest to them that they put on a search for used Dart Unions which have been discarded with pipe scrap—and that when Dart Unions **are** found, they be put back on active duty.

We are making the same suggestion to manufacturers in advertisements appearing in a number of industrial publications—in the interest of metal conservation. We can make this suggestion because Dart's matched seats and air refined malleable iron nuts and bodies make it possible for Dart Unions to be re-installed time and time again, giving the same complete satisfaction each time.

This "repeated performance" of Dart Unions explains why the purchase of Darts is an **investment** in long, trouble-free service for manufacturers. It explains why the **selling** of Darts is an investment in profit, repeat business and customer-satisfaction for **you**.

It pays **well** to sell Darts. Write for the Dart Jobber Policy **today**.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.
SALES AGENTS THE FAIRBANKS COMPANY NEW YORK AND ALL BRANCHES
CANADIAN FACTORY DART UNION COMPANY LTD TORONTO CANADA

Coming Events

All-Industry Refrigeration and Air Conditioning Exhibition: January 12-15, Stevens Hotel, Chicago, Ill. Sponsored by the Refrigeration Equipment Manufacturers Association (E. A. Vallee, president), 111 W. Washington St., Chicago, Ill.

American Society of Heating and Ventilating Engineers: Annual meeting, January 26-30, Philadelphia, Pa. Secretary, A. V. Hutchinson, 51 Madison Ave., New York, N. Y. For program, see p. 787.

Seventh International Heating and Ventilating Exposition: January 26-30, Commercial Museum, Philadelphia, Pa. Under auspices American Society of Heating and Ventilating Engineers and under management International Exposition Co., Charles F. Roth, president, Grand Central Palace, New York, N. Y.

Heating, Piping and Air Conditioning Contractors National Association: 53rd annual convention, May 25-28, Hotel Schroeder, Milwaukee, Wis. George J. Stoehr is chairman of the local convention committee. Headquarters office, 1250 Sixth Ave., New York, N. Y.

GUARD
COLD AIR DUCTS AND PIPING
WITH Novoid

YOU can give air ducts and piping lasting protection when you insulate with NOVOID CORKBOARD and CORK COVERING. This pure cork insulation bars the passage of heat, prevents duct and pipe line condensation, and helps control temperatures within desired ranges. For details and name of nearest Novoid Distributor, write Cork Import Corp., 330 W. 42nd St., New York City.

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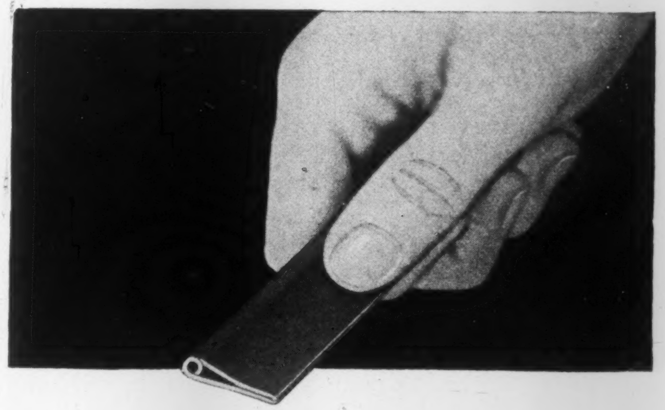

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STREAMLINED
and individually adjustable

Almost invisible without the aid of sectional photographs is the careful streamlining of each louvre in Waterloo adjustable supply grilles. Yet this one feature, so costly because of the many operations required to produce it, is a basic reason for the successful application of Waterloo Grilles.

Less resistance! Less noise at higher velocities! More effective directional control! Greater strength! All of these advantages and many more can be traced to this single feature.

The development and perfecting of such obscure details is characteristic of all Waterloo air diffusion equipment. No detail is too small, no problem too insignificant to escape the exacting research of Waterloo engineers. It is just another assurance that "Specifying Waterloo" means the selection of superb equipment in the field of air distribution.

WATERLOO REGISTER COMPANY
Waterloo, Iowa Seattle, Wash.
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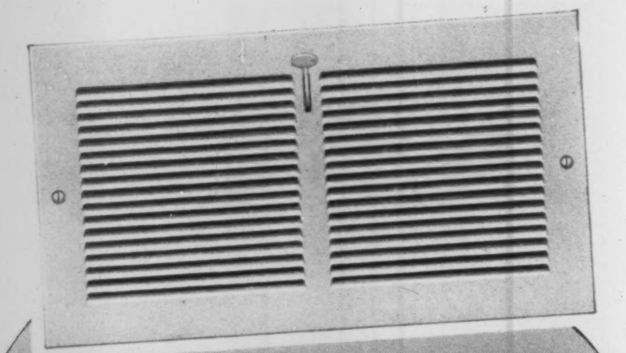
Waterloo
AIR DIFFUSION EQUIPMENT



AIRO-FLEX
7000 SERIES
REGISTERS
Adjustable for Up-and-Down Flow

The Auer Airo-Flex "7000" line gives you adjustable air conditioning registers which are very moderately priced, but well made and substantial in every detail. These are single louvre registers, of especially simple construction, without complicated mechanism. Grille members are quickly adjusted with turning tool, up, straight or to a downward angle of 22°. When you install a high-grade heating unit, a really efficient register of this type is also necessary to assure satisfactory results on the whole system. For this purpose there is no more inexpensive GOOD QUALITY register than the Airo-Flex "7000".

Auer makes many other designs in adjustable and non-adjustable air conditioning registers and intakes for every purpose, also a complete line of gravity registers and intakes. Write for Auer Register Book 41—or, for your grille requirements, ask for special Auer Grille Catalog "G".

THE AUER REGISTER COMPANY
3608 Payne Avenue Cleveland, Ohio

AUER REGISTERS
& GRILLES
For Air Conditioning *and* Gravity

Trade Literature

For your convenience in obtaining copies of these bulletins, see coupon on page 112. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending your request to HEATING, PIPING AND AIR CONDITIONING.

No. 4040. AIR DIFFUSERS: Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn. 4 p. bulletin announcing "Aerofuse" ceiling air diffusers manufactured of steel, describing types available, method of installation and listing the manufacturer's representatives in various cities.

No. 4041. AUTOMATIC VALVES: Foster Engineering Co., 109 Monroe St., Newark, N. J. Comprehensive catalog (70) on automatic valves of numerous types, including reducing valves, temperature regulators, pump governors, relief valves and back pressure valves. There is an extensive engineering data section on selection of steam pressure regulators; capacities of pressure regulators for steam, for gases and for water; effect of reducing valves on steam conditions; flow of steam; and other practical and technical information. (Copy of this catalog will be sent to executives and engineers engaged in those industries serving national defense if the request is written on company letterhead.)

No. 4042. BOILER PLUGS: Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass. Leaflet describing collapsible and fusible boiler plug which collapses when the nut is struck with a hammer.

REZNOR Gives You More Heat at . . .
LOW COST
PER HOUR

HERE'S an attractive, self contained gas heating plant which provides safe, trouble-free heat ECONOMICALLY. Installation and maintenance costs hit a NEW low. Suspended from the ceilings in factories and commercial buildings, they move more warm air over larger areas with less noise and at lower cost. You sacrifice these features with other types of heating. For years, Reznor Heaters have been giving uninterrupted service to many of America's important industrial and commercial buildings. Reznor Line is complete. Write for interesting catalog U 42 today.

Suspended Fan and Blower Types . . . .

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"GAS HEATERS EXCLUSIVELY SINCE 1888"

No. 4043. BOILER WATER FEEDERS: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. 4 p. condensed catalog and price list on boiler water feeders, low water cut-offs, feeder cut-off combinations, safety relief valves, and humidifier water level controls. A useful table of service recommendations is included. Contractors' and wholesalers' discounts and net prices are given on separate sheets.

No. 4044. DIESEL ELECTRIC SETS: Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill. 20 p. booklet (Form 6905) on generating electricity with diesel electric sets at a reported cost of 1c per kilowatt hour.

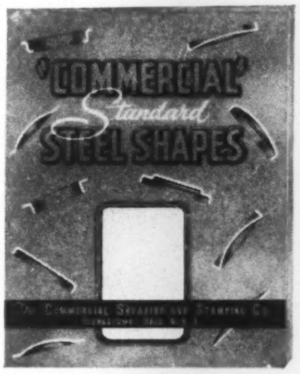
No. 4045. HEAT EXCHANGERS: Downingtown Iron Works, Heat Transfer Div., Wallace, Ave., Downingtown, Pa. 4 p. bulletin on heaters, coolers, condensers and other types of heat exchangers of steel, straight chrome, chrome nickel steel, copper, silicon bronze, wrought iron, nickel and nickel clad steel. Six types are illustrated and described briefly.

No. 4046. HEATING EFFICIENCY: Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn. Issue of Temperature Times (Vol. 1, No. 6) featuring an article on automatic heating efficiency and presenting a check sheet for heating efficiency. Importance of efficient heating in connection with national defense is stressed.

No. 4047. HUMIDIFIERS: Armstrong Machine Works, 874 Maple St., Three Rivers, Mich. 8 p. bulletin on steam type humidifiers of large capacity, with useful information on humidification and the need for it in various industries, features of these humidifiers, their

Shapes

A NEW BOOKLET FOR MANUFACTURERS USING STEEL SHAPES FOR TOPS, BOTTOMS, LIDS, OR—ANY OTHER PURPOSE


'COMMERCIAL' Standard STEEL SHAPES
The Commercial Shearing and Stamping Co.

THIS BOOKLET POINTS THE WAY TO SAVINGS

NO DIE OR TOOL CHARGES

WE SELL THESE SHAPES ONE OR A CARLOAD
JUST THE THING FOR EXPERIMENTAL JOBS
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THE COMMERCIAL SHEARING & STAMPING CO.
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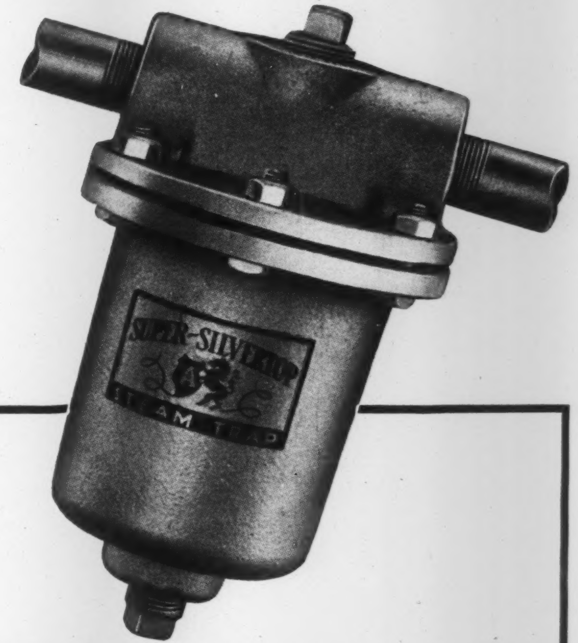
The ONLY Steam Trap with



STRAIGHT-IN-LINE
plus
ELBOW CONNECTION
plus
GUIDED INVERTED BUCKET
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NO CORED PASSAGES

NOT JUST ONE but *all four* trap features—that's what you get with Anderson Super-Silvertop and only with Super-Silvertop.

Straight-in-line piping saves fittings and installation labor because you need not buy and install extra, expensive fittings in any size trap. Straight-in-line piping also presents a neater, streamlined appearance that is in keeping with other modern equipment.

Besides, all Super-Silvertop pipe connections are in the head of the trap and this gives a savings in head room as well as greater ease of inspection without disturbing pipe connections.

But Anderson Super-Silvertops have other features — optional elbow connections, guided inverted bucket and drilled, *not cored* passages within the trap. These features plus long, trouble free service life and a company backed by 54 years of steam trap manufacturing experience are the reasons for the constantly growing popularity of Anderson Super-Silvertop steam trap —the engineered steam trap that has everything. Do you want a copy of the book, "How To Choose a Steam Trap"? It's free.

THE V. D. ANDERSON CO.
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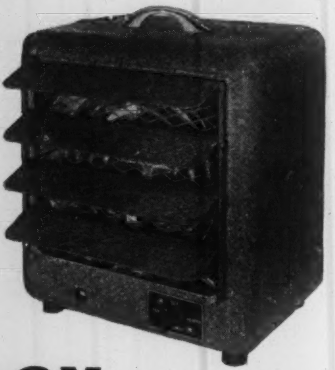
Put it where you want it—and keep warm with ELECTRIC HEAT



Chances are you use electric heat for processing or other plant use. Why not for comfort heating too—and for the same reasons, because it is quick to install, economical, works at any time, keeps uniform temperature. You can heat any size room or area with

CHROMALOX
ELECTRIC AIR HEATERS

The type illustrated, with its streamlined design and crackle-enamel finish, fits into the most tastefully appointed office, and stands ready at all times to furnish comfort-heat—day, night, week-day, Sunday, holiday. Blower can be operated independently of heating function for Summer cooling. Built around one of the famous Chromalox Electric Heating Units, used for every industrial heating purpose—and fully described in the Chromalox Book of Electric Heat—on request.

Above is the Type HF heater, available in four sizes from 1.5 to 4-KW. Other types up to 40-KW for heating factory space and other large areas. Thermostatic control if desired.

The ease of installing these units makes them ideal for heating isolated or remote rooms without piping difficulties or the hazards of naked flame.

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CONSERVES LOW TEMPERATURE

selection and their installation. Hook-up diagrams and recommended pipe sizes are given.

No. 4048. HUMIDITY CONTROL: Surface Combustion Corp., 2375 Dorr St., Toledo, Ohio. Series of bulletins on "Kathabar" humidifying and dehumidifying equipment for comfort and industrial process air conditioning by means of lithium chloride. The bulletins feature the importance of independent control of humidity both winter and summer, and contain a clear and concise explanation of the "Kathabar" method.

No. 4049. INSULATION: Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J. Leaflet announcing an insulating block with mineral base for low temperature work, known as "Koldboard," which is available in blocks 36 in. long; 12, 18 and 24 in. wide; ½ to 2 in. thick.

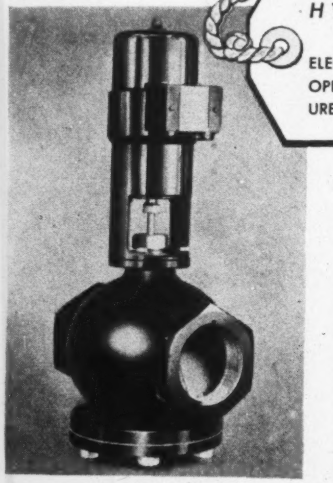
No. 4050. LUBRICATION: Texas Co., 135 E. 42nd St., New York, N. Y. Issue of publication Lubrication (Vol. 27, No. 10) devoted to improving lubrication of gas engines.

No. 4051. MOLYBDENUM IN STEEL: Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y. Revised sections for the manufacturer's publication on molybdenum in steel, presenting data heretofore unavailable and including information on carbon molybdenum steels, molybdenum tool steels, molybdenum high speed steels and physical property charts for all of the SAE steels. Data on normal hardening and depth hardening of the steels have been included.

No. 4052. MOTOR PUMP UNITS: Ingersoll-Rand, 11 Broadway, New York, N. Y. 40 p. catalog on "Cameron Motorpump" line, which includes a wide range of sizes, types, mountings and driver combina-

TODAY'S SOLUTION TO MANY A KNOTTY VALVE PROBLEM

GENERAL CONTROLS
HYDRAMOTOR VALVE
TYPE G-2
ELECTRICALLY DRIVEN • HYDRAULICALLY OPERATED • TWO-WIRE CURRENT FAILURE OPERATOR SEALED IN OIL FOR LIFE



SIMPLIFY most every valve control installation with this versatile valve. Handles all liquids, gases and vapors. Full ported. Available normally open or normally closed. Slow opening, slow closing. No gears. Operates in any position. Low in current consumption. Sizes ½" to 6" I. P. S. Write for details, pressures and specifications. Also ask for Catalog.

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tions. Features of the units are described and illustrated in detail and tables of performance data and information on applications are included. There are also engineering data and the solution of a typical pump problem.

No. 4053. ODOR ADSORBERS: W. B. Connor Engineering Corp., Dorex Div., 114 E. 32nd St., New York, N. Y. 4 p. bulletin describing the portable "Type A" odor adsorber, illustrating many of its practical uses. The adsorptive medium employed is highly activated coconut shell carbon.

No. 4054. PIPE: Republic Steel Corp., Republic Bldg., Cleveland, Ohio. 48 p. catalog on "Toncan" iron pipe discussing its advantages for tough service; describing its manufacture; discussing its features of interest to the owner, the architect, the engineer, and the contractor; giving data on corrosion resistance, physical properties, fabrication, threading and welding; and including an extensive listing of numerous installations for a wide variety of services, classified by the services and by types of buildings.

No. 4055. PIPE COMPOUND: Black Magic Products Co., P. O. Box 1703, Tulsa, Okla. Leaflet describing pipe sealing compound and gasket cement for gasoline, oil and other petroleum base solvents.

No. 4056. PUMPS: Pomona Pump Co., 206 E. Commercial St., Pomona, Cal. 24 p. brochure on industrial pumps, containing many illustrated case histories on various applications and a number of practical drawings of assistance in layout.

No. 4057. RECORDERS: C. J. Tagliabue Mfg. Co., 540 Park Ave., Brooklyn, N. Y. 24 p. catalog (1210) on "Tag" recording instruments for temperature and

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by SAMUEL R. LEWIS

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Easy to understand . . . accurate . . . comprehensive . . . up-to-date—these are the features of this third edition of Samuel R. Lewis' well-known AIR CONDITIONING FOR COMFORT. More than 70% of the text in this third edition is entirely new, as are dozens of the illustrations, charts, tables, and designing examples.

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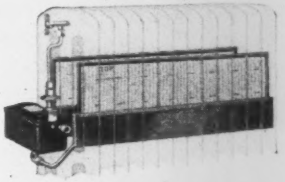
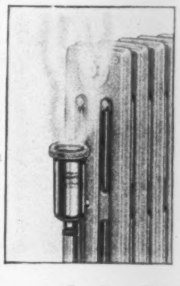
Efficient · Economical · Automatic
HUMIDIFICATION
for every type of heating system!

Ol' Faithful
For Hot Water or
Steam Radiators



Here is efficient, automatic humidification for hot water or steam heated buildings. With a temperature of 130 degrees at the radiators as much as 1½ gallons of water are evaporated daily. Water supply is taken from nearest water pipe or direct from hot water radiators, which are vented automatically. Furnished in three lengths 18, 24 or 34 inches. Easily installed.



For Low Pressure
Steam Radiators

MAID-O'-MIST 95 Auto Vent

A simple, automatic humidifier and quick air-vent that replaces the air valve on any low pressure steam radiator. At one pound steam pressure it discharges a pint of water-vapor every hour. Regulating knob controls the output. Can be installed on risers and in batteries on loops. Thousands now in use in homes, offices, factories, public buildings, etc.

Catalog Sheet 701 describes entire line. Sent FREE

MAID-O'-MIST, INC. 211 N. Aberdeen St.
Chicago, Illinois

Serving the
REFRIGERATION
INDUSTRY

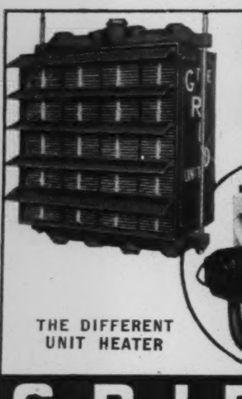
HYDRON
METALLIC BELLOWS
produced
hydraulically
BY
CLIFFORD MANUFACTURING CO.
564 E. FIRST STREET, BOSTON
BOSTON CHICAGO DETROIT LOS ANGELES
PRODUCERS OF BELLOWS EXCLUSIVELY
SERVING AUTOMATIC CONTROL MANUFACTURERS
COMPLETE ENGINEERING SERVICE

NOZZLES
for Air Washing

Yarway Involute Design—with no internal parts or vanes — insures non-clogging trouble-free service. Sizes and types to meet all requirements. Successful installations of Yarway Involute Nozzles in water cooling and air conditioning service total more than 5 million gallons per minute. Write for Bulletin N-615.

YARNALL-WARING CO., PHILA.
107 MERMAID AVENUE

YARWAY



YOU CAN DEPEND ON GRID UNIT HEATERS

... No electrolysis
... More air changes per hour
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... Long life of unit

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Unit Heater & Cooler Division
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THE DIFFERENT UNIT HEATER

GRID UNIT HEATER

√ *Accurate*
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. . . That's the story behind the success of HEATING, PIPING and AIR CONDITIONING Annual Directory and Show Number to be published next January. Its completeness, accuracy and convenience have made it indespensable to engineers and contractors throughout the year for reliable reference in their buying and specifying work. Further information sent on request.

KEENEY PUBLISHING COMPANY
6 North Michigan Ave. Chicago, Ill.

pressure, presenting information on the manufacturer's latest recorder developments, and carefully illustrating and describing the various instruments.

No. 4058. SAFETY EQUIPMENT: American Optical Co., Southbridge, Mass. 111 p. safety equipment catalog describing items for complete protection from head to ankles, including welding lenses, welding plates, welding helmets and hand shields, goggles, respirators, safety clothing, etc.

No. 4059. SAFETY RELIEF VALVES: McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill. Bulletin originally issued for the manufacturer's representatives on safety relief valves for hot water heating boilers, discussing their high discharge capacity and including a thorough presentation of some important facts about heating boilers.

No. 4060. SHEARS: Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. 20 p. bulletin (71-H) on power squaring shears with capacities up to 14 ga.

No. 4061. STEEL SHAPES: Commercial Shearing and Stamping Co., 1775 Logan, Youngstown, Ohio. 16 p. booklet (Section 3) on standard steel shapes, comprising drawings and data on steel shapes included in the manufacturer's standard line. Products include tank heads and tank accessories, furnace heads and stampings, steel tunnel lining, fabricated and welded parts, medium and heavy stampings, hydraulic equipment, steel pallets for the concrete block industry, and others. Drawings and complete dimensions are included.

No. 4062. STOKERS: Iron Fireman Mfg. Co., 3170 W. 106 St., Cleveland, Ohio. 20 p. catalog (Form 7121) on "Poweram" heavy duty stokers for boilers developing up to 400 hp, describing and illustrating in detail features of design and construction and discussing proper installation and applications.

No. 4063. STOKERS: Kol-Master Corp., Oregon, Ill. 22 p. catalog (541) on heavy duty stokers for commercial and industrial applications, describing in detail features of design and construction, discussing principles of combustion, and giving capacity and rating data.

No. 4064. SUB-CONTRACTING: General Electric Co., 1 River Rd., Schenectady, N. Y. Quarterly report to stockholders of the company devoting particular attention to sub-contracting for speeding defense production.

No. 4065. WELDING COURSES: Lincoln Electric Co., 12818 Coit Rd., Cleveland, Ohio. 4 p. folder describing the manufacturer's welding engineering course and welding school, with a coupon for obtaining further information on the course.

No. 4066. WELDING PROCEDURES: Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y. 54 p. booklet on welding procedures, designed to clarify the proper welding process for a particular metal under various circumstances. In addition to recommending processes, the book recommends the best filler metal and describes various specialized welding techniques. Data are given in an appendix for calculating electrode and gas welding rod consumption for different types of welds, and there are several comparative welding record sheets for tabulating data that will determine the best welding method for a particular job.

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READ ALL ABOUT IT!

TONCAN
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TONCAN IRON PIPE
FOR TOUGH SERVICE
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Read all the up-to-date facts about Toncan* Iron—the pipe made of *open-hearth iron* alloyed with copper and molybdenum for greatest rust and corrosion-resistance among ferrous materials in its price class.

This new Toncan Iron Pipe booklet is the finest and most complete ever published. From cover to cover are 48 pages of interesting reading—telling what Toncan Iron is made of, how it's made, why it resists corrosion, its other features and advantages, results of tests. It gives fabricating data and specifications—tells how it is used and its record of service—suggests ways to increase the life and reduce the cost of piping systems.

There's one of the new Toncan Iron Pipe booklets ready to be put in the mail for you. A request is all it takes to get it on its way. Write for your copy, today.

*Reg.U.S.Pat.Off.

RESEARCH WILL NOT STOP!

One of our most important activities at Republic always has been research. Today's emergency has not retarded this work. On the contrary, it has greatly intensified our efforts.

We are carrying on a relentless and unceasing program directed toward the development of new steels for certain critical defense problems and the improvement of present steels.

Laboratory and plant research, commercial market research, product development research—all are exploring every possible avenue which may lead to *better* Republic steels for you in the future.

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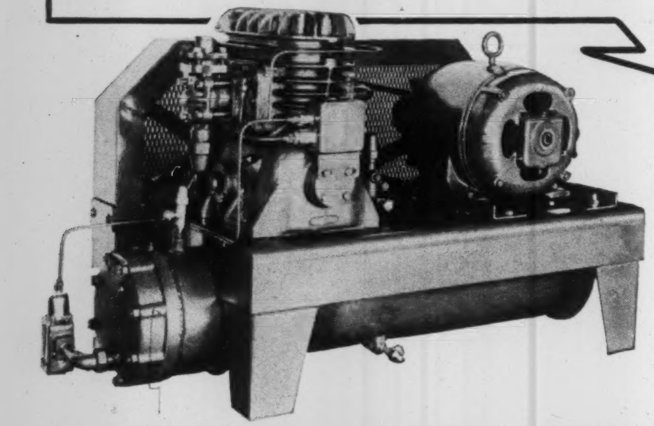
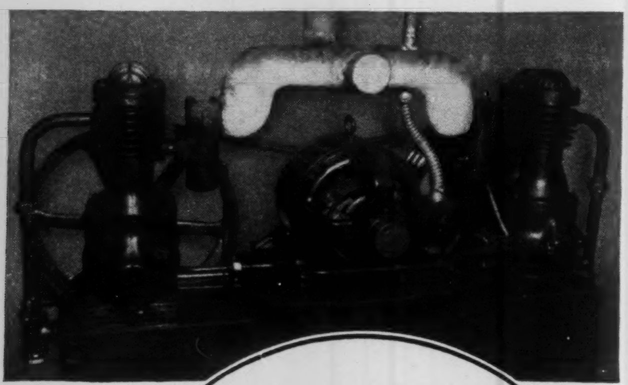
REPUBLIC TONCAN IRON

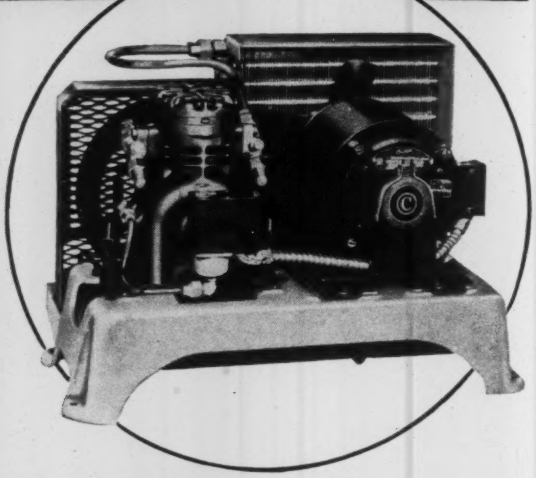
An alloy of refined open-hearth iron, copper and molybdenum—*that grows old slowly*

Build Your Present and Future Reputation Now With CENTURY MOTORS

For Every Air Conditioning Need







Top — Century Squirrel Cage Motor driving a refrigeration compressor.

Center — Century Direct Current Motor driving a refrigeration compressor.

Bottom — Century Repulsion Start Induction Motor driving a refrigeration compressor.

It's to your advantage — for present and future, post-war years — to be sure that every refrigeration and air conditioning installation is powered to provide smooth, quiet, and economical performance at all times.

How can you be sure of such results? That's easy! By being sure that the motor accurately and adequately meets the starting, accelerating, and running requirements of the installation.

That means specifying Century Job Selected Motors — motors especially designed to meet the demands of each item built by the refrigeration and air conditioning industry.

Whether you are selling and installing unit heaters, coolers, stokers, fans, pumps, blowers, or compressors, it will pay you to use the complete Century line of fractional and integral motors — it's easy for you to select the right motor for the job.

Century Offers These Outstanding Advantages for Air Conditioning Applications

- Unusual freedom from electrical and mechanical vibration
- Century's unique bearing bumpers reduce chatter from V-belt irregularities
- Cushion base mountings isolate possible vibration from your installation
- Quiet starting, quiet acceleration, and quiet running is assured at all times
- The high starting torque so necessary in operating modern compressors

Your nearest Century Motor Specialist will gladly help you and your engineers to select the proper Century Motor for any air-conditioning or refrigeration use. His advice is valuable — call him in today.

CENTURY ELECTRIC CO.
1806 Pine Street St. Louis, Missouri

Offices and Stock Points in Principal Cities

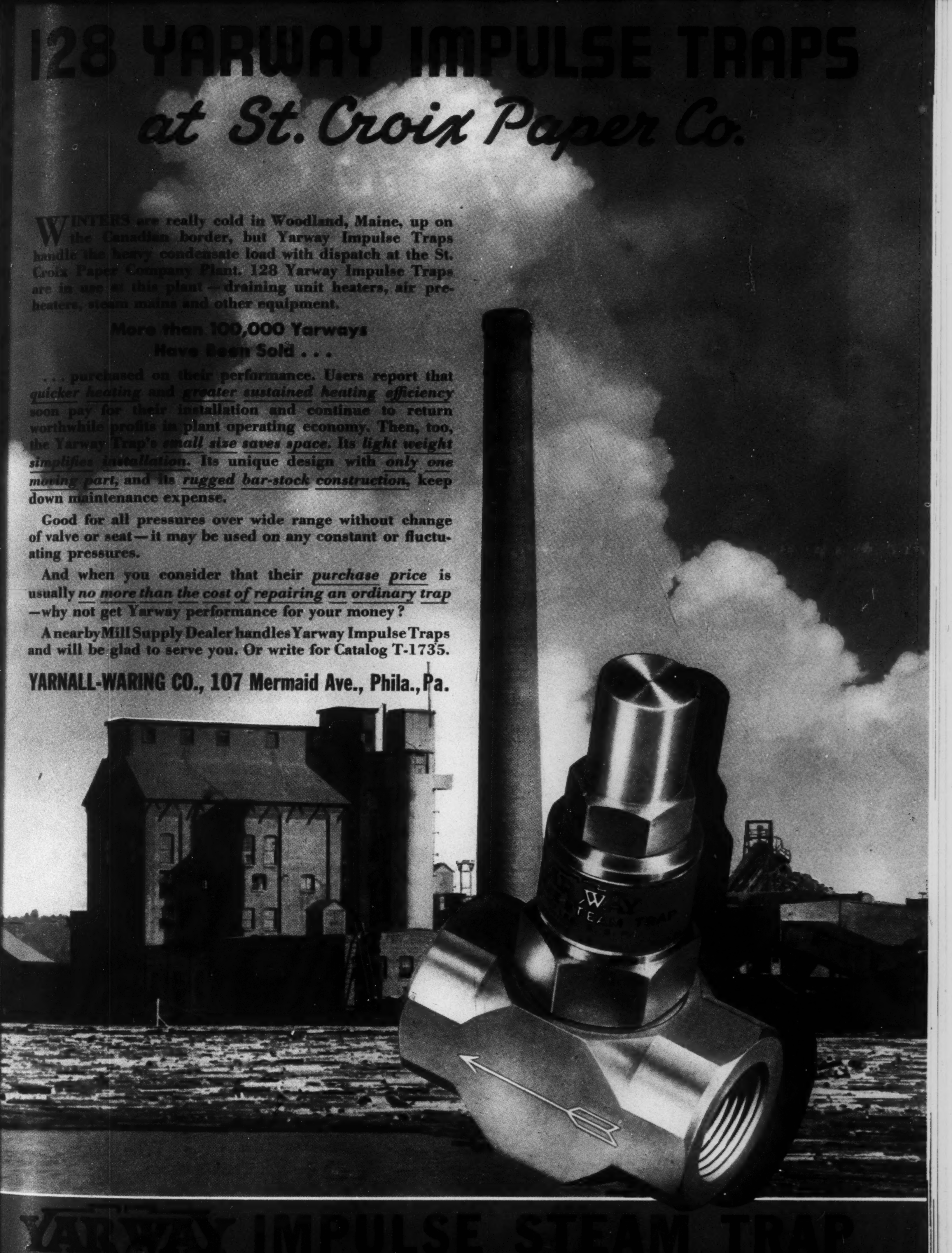
Century MOTORS

One of the Largest Exclusive Motor and Generator Manufacturers in the World

HEATING, PIPING and AIR CONDITIONING, published monthly by Keeney Publishing Co., 6 N. Michigan Ave., Chicago, Ill., U. S. A. Subscription rates: U. S. and possessions, Canada, Mexico, Central America, South America, $2.00 per year; other, $4.00. Current copies, U. S. and possessions, 25 cents. Back numbers, 50 cents. December, 1941. Vol. 13, No. 12. Entered as Second Class matter May 18, 1929, at the Post Office at Chicago, Ill., U. S. A., under the act of March 3, 1879.

128 YARWAY IMPULSE TRAPS

at St. Croix Paper Co.



WINTERS are really cold in Woodland, Maine, up on the Canadian border, but Yarway Impulse Traps handle the heavy condensate load with dispatch at the St. Croix Paper Company Plant. 128 Yarway Impulse Traps are in use at this plant—draining unit heaters, air preheaters, steam mains and other equipment.

More than 100,000 Yarways Have Been Sold . . .

. . . purchased on their performance. Users report that *quicker heating* and *greater sustained heating efficiency* soon pay for their installation and continue to return worthwhile profits in plant operating economy. Then, too, the Yarway Trap's *small size saves space*. Its *light weight simplifies installation*. Its unique design with *only one moving part*, and its *rugged bar-stock construction*, keep down maintenance expense.

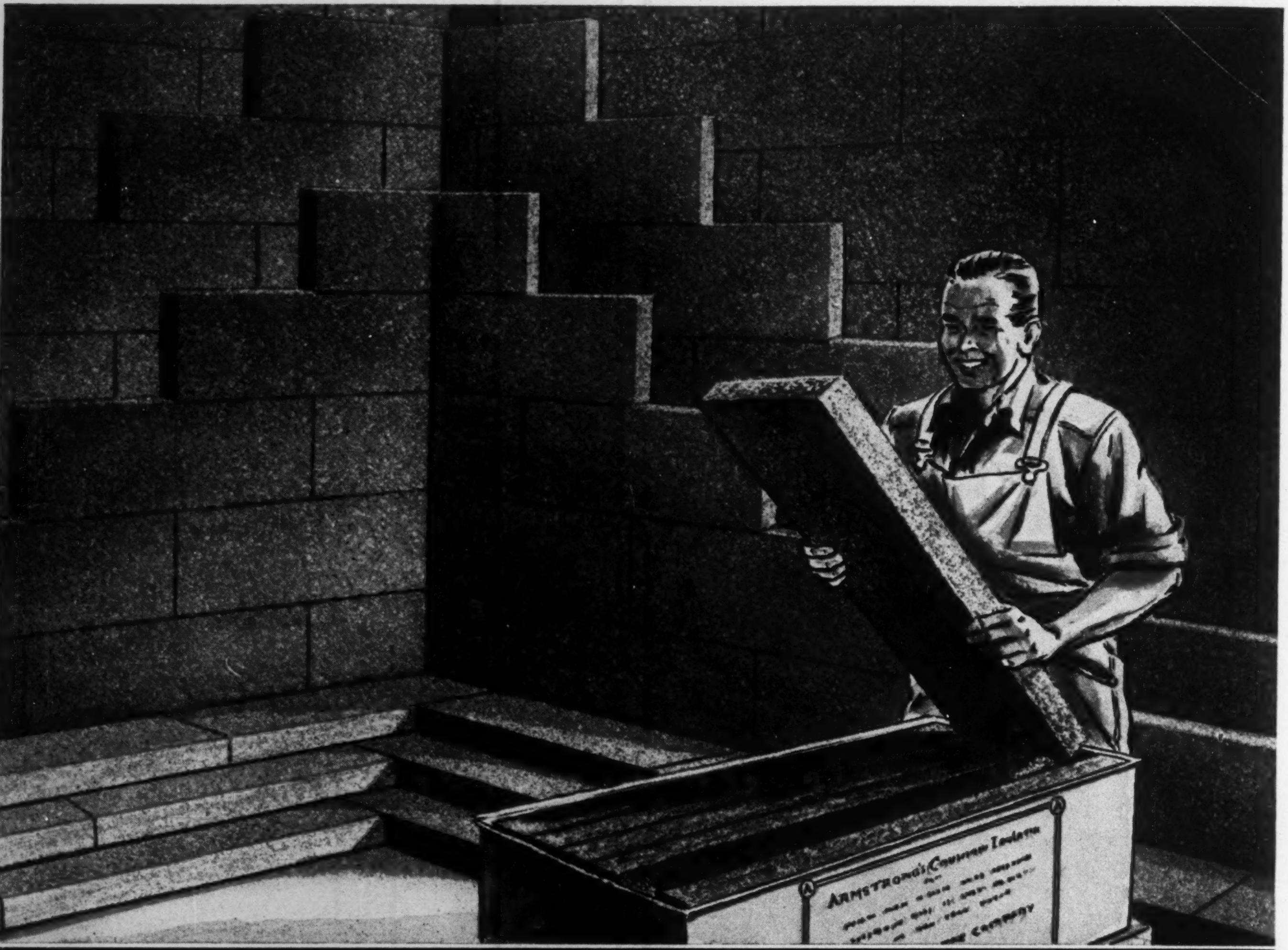
Good for all pressures over wide range without change of valve or seat—it may be used on any constant or fluctuating pressures.

And when you consider that their *purchase price* is usually *no more than the cost of repairing an ordinary trap*—why not get Yarway performance for your money?

A nearby Mill Supply Dealer handles Yarway Impulse Traps and will be glad to serve you. Or write for Catalog T-1735.

YARNALL-WARING CO., 107 Mermaid Ave., Phila., Pa.

YARWAY IMPULSE STEAM TRAP



CORKBOARD insulation is again AVAILABLE

THE cork supply situation is much improved. Cork is still under OPM control but the Government's reserve stock pile, to care for emergency requirements in the event Spanish and Portuguese ports are closed, has been substantially increased. This means that shipments now arriving can be utilized to meet most needs for corkboard insulation, first for defense work and then for work involving food preservation. Restrictions on the use of corkboard for insulating roofs and air conditioning ducts still apply.

Whatever may be your needs for low temperature insulation, get in touch with your Armstrong Cork man. Let him know how much corkboard you need, how it will be used, and when you will want it delivered. We expect to be able to make prompt delivery of all usual quantities dependent upon continued favorable shipping conditions and upon Government requirements. We will be glad to give you information quickly about your specific needs.

Get in touch with us early . . . if possible even before drawings are prepared . . . so that our insulation specialists will have time to work out your problem with you in the most effective way. This early information will help us to give you the best possible delivery service.

Prompt Delivery of CORK COVERING

Armstrong's Cork Covering for cold lines and fittings is used largely in defense plants or in plants requiring refrigeration to protect perishable foodstuffs. Due to this fact and because the relatively small amount of cork used has not hindered the Government's cork reserve program, we can meet practically all needs for cork covering promptly. This insulation is made in sizes for all standard piping.

For information on deliveries of corkboard and cork covering call our nearest office or distributor, or write direct to Armstrong Cork Company, Building Materials Division, 994 Concord Street, Lancaster, Pa.

ARMSTRONG CORK COMPANY
Insulation Headquarters

★ CORKBOARD ★ CORK COVERING ★ FIBERGLAS* ★ TEMLOK ★ INSULATING FIRE BRICK ★
*Reg. U. S. Pat. Off. O.-C. F. Corp.

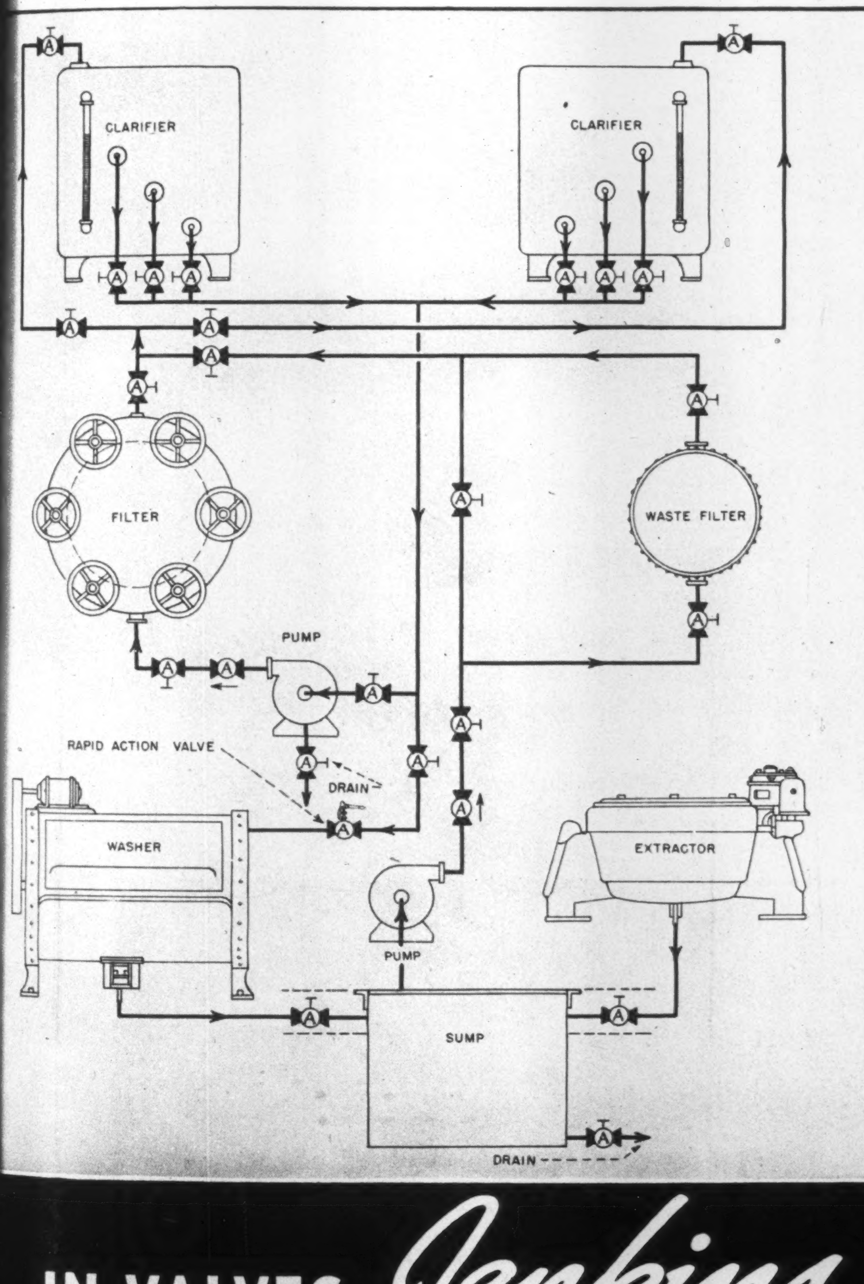
"GOOD *VALVE* PRACTICE"

For a Dry Cleaning Plant

(PROCESS PIPING)

Jenkins SUGGESTS . . .

Many Dry Cleaning plants are small automatic systems in which several or all components are bought as one unit. Others are larger, more flexible plants varying greatly in complexity of piping and the type of work handled. For all these installations, however, there must always be sufficient points of control so that the cleaning fluid can be filtered and clarified until suitable for re-use. Bronze or Iron valves are suitable for this service. Although standard pressure valves are generally used, in the reference chart we have listed Jenkins Figure Numbers to include extra-heavy patterns. Steam piping to the Tumbler will be small—using Bronze Globes or Gates.



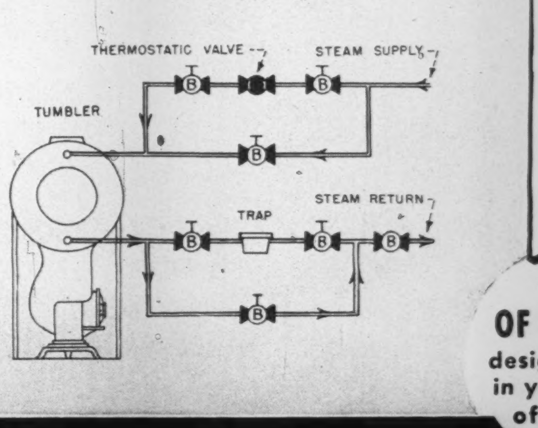
REFERENCE CHART FOR JENKINS FIGURE NUMBERS

	Standard	Medium	Extra Heavy
A SOLVENT LINES GATE	BRONZE 47 Sc. Travel. Spindle 49 Sc. Travel. Spindle 370 Sc. Non-Rising IRON 325 Sc. Non-Rising 326 Fl. Non-Rising	BRONZE 270 Sc. Non-Rising IRON 251 Sc. Non-Rising 255 Fl. Non-Rising	BRONZE 280 Sc. Non-Rising IRON 203A Sc. Non-Rising 203 Fl. Non-Rising
SWING CHECK	BRONZE 92 Sc. Regrinding 352 Sc. Disc Type 762 Sc. Regrinding IRON 623 Sc. Regrinding 624 Fl. Regrinding 294 Sc. Disc Type 295 Fl. Disc Type	BRONZE 762 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type	BRONZE 260 Sc. Disc Type 962 Sc. Regrinding IRON 338 Sc. Disc Type 339 Fl. Disc Type
GLOBE	BRONZE 106A Sc. Disc Type IRON 612 Sc. Regrinding 613 Fl. Regrinding 141 Sc. Disc Type 142 Fl. Disc Type	BRONZE 750 Sc. Regrinding 950 Sc. Regr.-Renew IRON 918 Sc. Regrinding 919 Fl. Regrinding 774 Sc. Disc Type 775 Fl. Disc Type	BRONZE 801 Sc. Disc Type 1140 Sc. Regrinding 1150 Sc. Regr.-Renew 970 Sc. Regr.-Renew IRON 922 Sc. Regrinding 923 Fl. Regrinding 162A Sc. Disc Type 162 Fl. Disc Type
QUICK OPENING	BRONZE 720 Sc. Disc Type IRON 334 Sc. Sliding Spindle		
B STEAM LINES GLOBE	BRONZE 106A Sc. Disc Type 750 Sc. Regrinding 950 Sc. Regr.-Renew 956 Sc. Regr.-Renew Plug	BRONZE 801 Sc. Disc Type 1140 Sc. Regrinding 1150 Sc. Regr.-Renew	BRONZE 970 Sc. Regr.-Renew 976 Sc. Regr.-Renew Plug
GATE	BRONZE 47 Sc. Travel. Stem 49 Sc. Travel. Stem 370 Sc. Non-Rising	BRONZE 270 Sc. Non-Rising	BRONZE 280 Sc. Non-Rising
SWING CHECK	BRONZE 92 Sc. Regrinding 352 Sc. Disc Type	BRONZE 762 Sc. Regrinding	BRONZE 260 Sc. Disc Type 962 Sc. Regrinding

Motor-operated Iron and Steel Valves can be supplied.

JENKINS BROS., 80 White St., New York, N.Y.: Bridgeport, Conn.; Atlanta, Ga.; Boston, Mass.; Philadelphia, Pa.; Chicago, Ill.; Houston, Texas. Jenkins Bros., Ltd., Montreal; London, Eng.

Diagram by
Huxley Madeheim,
Consulting Engineer



#11
OF A SERIES
designed to help in your selection of JENKINS VALVES

IN VALVES *Jenkins* GIVES YOU EVERYTHING

RUST-FREE!
DEPENDABLE!
EASY-TO-INSTALL!
ANACONDA TYPE K

...and *Most* Economical in the Long Run!

THE worst enemy facing our national defense program is TIME. Rusted-out pipe wastes time in replacement . . . and it wastes money, too. Sometimes even the mere presence of rust can spoil work in process.

Fortunately many plants in our vital industries have copper tube for various types of fluid conveying lines. These are economical installations, moderate in first cost, low in maintenance.

That's why so many cost-minded maintenance men regard Anaconda Copper Tubes as the piping that's the most dependable and the least expensive in the long run.

Today, "non-defense" orders for copper tubes will have to wait. Meanwhile, with an eye to the future, why not send for our new booklet on Copper Tubes in industry?

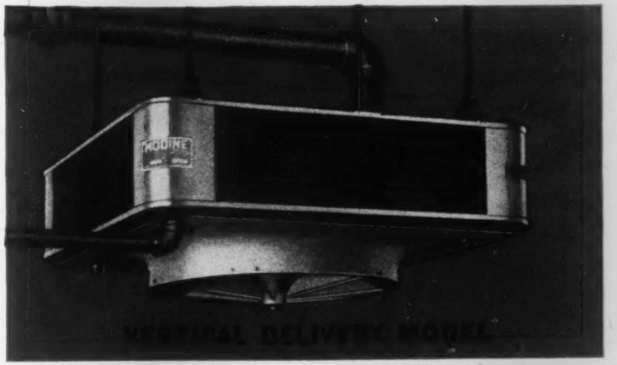
4118-B

ANACONDA
from mine to consumer

Anaconda Copper Tubes

THE AMERICAN BRASS COMPANY, General Offices: WATERBURY, CONN.
Subsidiary of Anaconda Copper Mining Company • In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ASLEEP AT THE SWITCH . . . .
SIMON DEGREE WILL RUN HIM DOWN
TOO HOT
TOO COLD


VERTICAL DELIVERY MODEL

MODINES WOULD HAVE SAVED HIM

This unfortunate "executive" recently bought some unit heaters. He "got a good price on them," and took quality for granted. Asleep at the switch—he just didn't think far enough ahead. And neither did his contractor.

Neither of them will "wake up" until Simon Degree jolts the customer with a lot of big bills for operation and up-keep. Simon Degree is the personification of built-to-meet-a-price heating equipment and all the grief that comes with it. It may take five years for Simon to get his man, but he's as sure as death *and taxes.*

Instead of cutting cost corners today, farseeing management is keeping an eye on tomorrow's profits

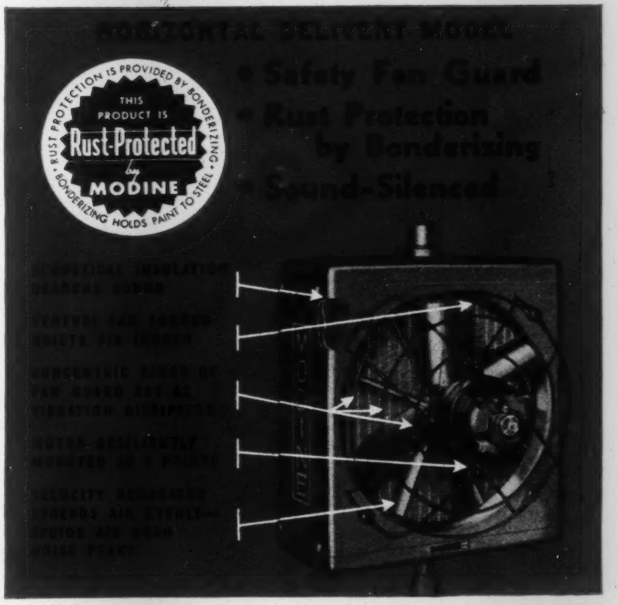
Sell the adequate, effective heating of Modine Unit Heaters that will be just as vital to production five years from now as today.

And Modine quality—in design—in engineering—and in superior materials—is a paid-up policy in production insurance. The slight premium your customers may pay to get Modines comes back to them many times over in greater fuel savings, lower up-keep and longer life.

When you recommend and install Modines your customer gets America's recognized standard. And *you can get just as good or better delivery from Modine.* Write for catalog.

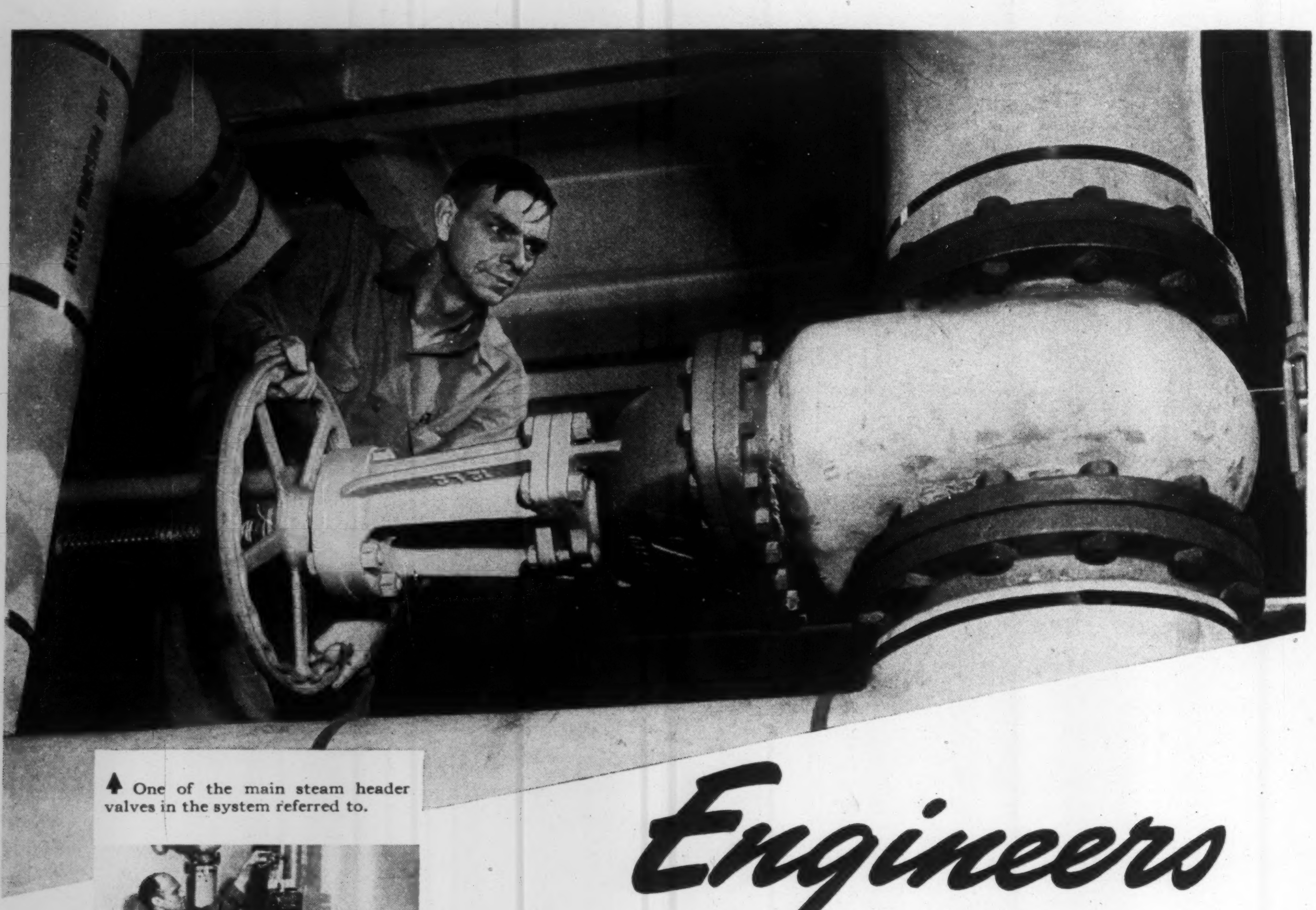
MODINE MANUFACTURING CO., 1772 Racine St., Racine, Wis.

☎ *Look in your phone book for Modine representative's name—"Where to Buy It" section under Heating Apparatus.*

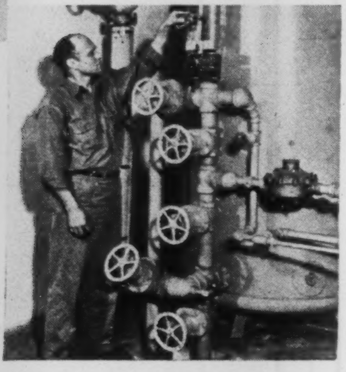

HORIZONTAL DELIVERY MODEL
• Safety Fan Guard
• Rust Protection by Bonderizing
• Sound-Silenced
RUST PROTECTION IS PROVIDED BY BONDERIZING • BONDERIZING HOLDS PAINT TO STEEL •
THIS PRODUCT IS Rust-Protected by MODINE
ACOUSTICAL INSULATION DEADENS SOUND
VENTURI FAN SHROUD QUIETS AIR INRUSH
CONCENTRIC RINGS OF FAN GUARD ACT AS VIBRATION DISSIPATORS
MOTOR RESILIENTLY MOUNTED AT 4 POINTS
VELOCITY GENERATOR SPREADS AIR EVENLY—AVOIDS AIR RUSH NOISE PEAKS

modine

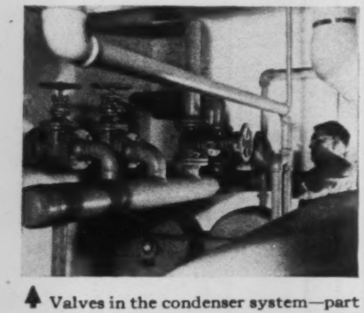
THE UNIT HEATER THAT IS FASTER AND EASIER TO INSTALL



One of the main steam header valves in the system referred to.



Illustrating READING-RRATT & CADY valves on the Refinite Water Softening system referred to in this advertisement.



Valves in the condenser system—part of the complete installation mentioned in this advertisement.

Engineers

SIMPLIFIED THE VALVE PROBLEM HERE

A recently installed plant called for valves on the main water supply, for water softeners, to handle boiler feed water, on steam lines, on condenser lines, for the air-conditioning plant, and so forth—services that operate under widely different temperatures, pressures and other conditions.

The engineers asked for—and accepted—recommendations from READING-PRATT & CADY and the plant is performing today up to the exacting specifications originally laid down for it.

READING-PRATT & CADY'S experience since 1878 might be very helpful to you, too. Write us, won't you, when you want to discuss valves—or for any information on valves.

READING-PRATT & CADY
DIVISION · READING, PENNSYLVANIA
AMERICAN CHAIN & CABLE COMPANY, INC.

WE'RE BEING TALKED ABOUT

EVERYWHERE YOU FIND A B & G *TRIPLE DUTY* SYSTEM YOU FIND AN OWNER WHO LOVES TO SHOW IT TO HIS FRIENDS

THIS B & G BOOSTER CIRCULATING PUMP IS ONE OF THE REASONS YOU'RE ALWAYS SO COMFORTABLE IN OUR HOME

One of the reasons B & G Triple Duty Heating jumps in popularity every year is because of its *word-of-mouth publicity!* Satisfied owners talk about it. Tell their friends. Lead them to the basement to display the simple B & G equipment which produces such marvelous results.

So you can bank on this—one B & G Triple Duty installation is sure to produce others!

The B & G Triple Duty Forced Circulation System supplies the missing link to completely satisfactory heating. It introduces a method of control which banishes the stuffy discomfort of an over-heated house, yet assures an adequate supply of heat when the weather demands it.

For the same reason, B & G Triple Duty Heating is gratifyingly easy on fuel—any kind. No excess heat is delivered, hence no excess fuel is burned.

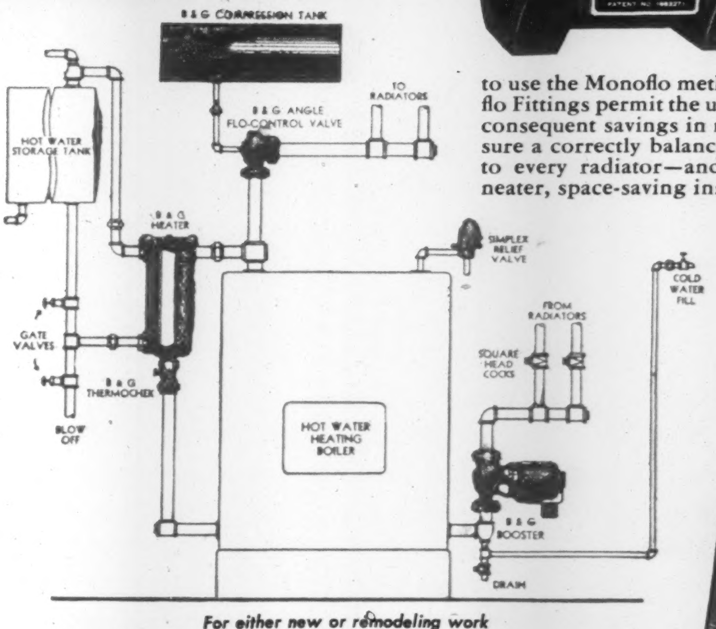
And, of equal importance to your net profit, B & G equipment has justly acquired a name for solid, dependable, service-free performance. The B & G Handbook gives all details—write for your copy.

RET↓URN
MON FLO
PATENT NO 1968271

FOR NEW INSTALLATIONS— THE B & G MONOFLO FITTING

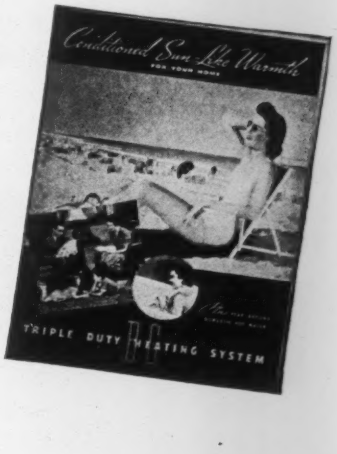
When putting a B & G Triple Duty System in a new home, be sure to use the Monoflo method of piping. B & G Monoflo Fittings permit the use of a *single* pipe main, with consequent savings in material and labor. They assure a correctly balanced distribution of hot water to every radiator—and the single main means a neater, space-saving installation.

In the home with a B & G Triple Duty System, domestic hot water is furnished the year around by the B & G Indirect Water Heater. Not in driblets, but all the family can use, 24 hours a day . . . and so inexpensively that its use need never be stinted. Play up this feature of Triple Duty Heating—it's the biggest economy and convenience story in modern heating.


B & G COMPRESSION TANK
HOT WATER STORAGE TANK
TO RADIATORS
B & G ANGLE FLO-CONTROL VALVE
B & G HEATER
SIMPLEX RELIEF VALVE
COLD WATER FILL
FROM RADIATORS
GATE VALVES
SQUARE HEAD COCKS
B & G THERMOCHEK
BLOW OFF
HOT WATER HEATING BOILER
B & G BOOSTER
DRAIN

For either new or remodeling work

SEND FOR THIS BOOKLET!
This new full color booklet presents the complete story, liberally illustrated, of B & G Triple Duty Heating. A great sales maker—send for a copy today.


Conditioned Sun-Like Warmth
FOR YOUR HOME
TRIPLE DUTY HEATING SYSTEM

B&G TRIPLE DUTY SYSTEM

BELL & GOSSETT COMPANY
MORTON GROVE, ILLINOIS *(Suburb of Chicago)*
Canadian Licensee: S. A. Armstrong, Ltd., 115 Dupont St., Toronto

Those tangents on WeldELLS are for *you*!

THE accurately formed straight segments on each end of every WeldELL are placed there for *your* benefit—to give *you* better engineered piping at lower cost.

They keep the weld away from the zone of highest stress, make lining up easier and facilitate the use of slip-on flanges with WeldELLS.

Tangents provide just one of *eight* good reasons for insisting on WeldELLS. Seven other extra value features are listed below.

► WeldELLS and other Taylor Forge Fittings for Pipe Welding and Forged Steel Flanges are stocked by authorized distributors in all principal cities. Ask your local distributor for a copy of Taylor Forge Catalog No. 401.

TAYLOR FORGE & PIPE WORKS, General Office & Works: Chicago, P. O. Box 485
New York Office: 50 Church Street • Philadelphia Office: Broad Street Station Bldg.

6" STD. TAYLOR FORGE WELDELL PAT. 1936805

WeldELLS have *everything* —

No other fittings for pipe welding combine these eight features. In addition to tangents these features are:

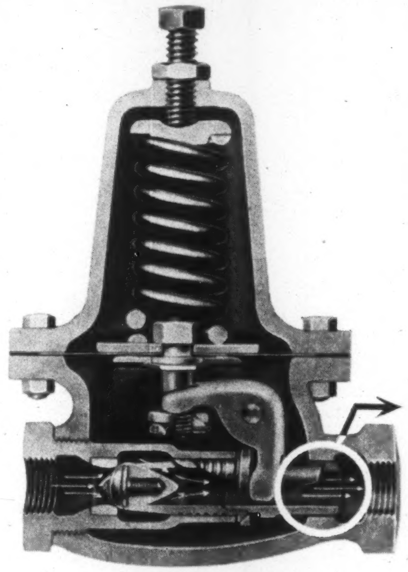
1. **Seamless**—Greater strength and uniformity.
2. **Precision quarter-marked ends**—simplify layout and help insure accuracy.
3. **Selective reinforcement**—provides uniform strength.
4. **Permanent and complete identification marking**—saves time and eliminates errors in shop and field.
5. **Wall thickness never less than specification minimum**—assures full strength and long life.
6. **Machine tool beveled ends**—provide best welding surface and accurate bevel and land.
7. **The most complete line of Welding Fittings and Forged Steel Flanges in the World**—insures complete service and undivided responsibility.

CASH STANDARD *Streamlined* REDUCING VALVE

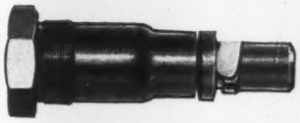
TYPE 1000 PRESSURE

3 IMPORTANT CONSTRUCTION FEATURES THAT GIVE YOU

Accurate, Reliable, Pressure Reduction Service for STEAM, AIR, OIL . . . Most Anything that Flows . . . AT DEFINITE COST SAVINGS



1 **Streamlined flow around the inner valve —eliminates turbulence— thereby gives you best control under varying loads.**



2 **Straight path for the fluid through the *flow tube* — gives you better pressure control and greater capacity.**

3 **The Aspirator gets the inner valve wide open to meet the demand and hold delivery pressure constant.**

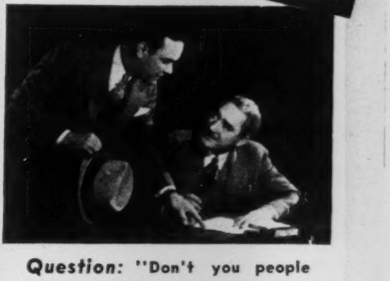
The Streamlined Type 1000 **is available with inlet pressures to 3000 lbs., delivering vacuum to 125 lbs. Sizes ¼" to 2" screwed ends. There are no complicated parts to get out of order — no small ports or passages to clog up — no close fits. You will get much longer, lower cost service and your attention costs will be down to the absolute minimum. Day after day you will experience smooth operation, accurate regulation, elimination of failures and spoilage — plus all this the Streamliner makes a definite contribution toward speedier production results and ends worry and bother that is ordinarily experienced.**

- *Send for Bulletin 1000—it gives you the complete story.*

A. W. CASH COMPANY
DECATUR, ILLINOIS

CASH STANDARD
CONTROLS . .
VALVES

A CASH STANDARD "GET ACQUAINTED" COLUMN

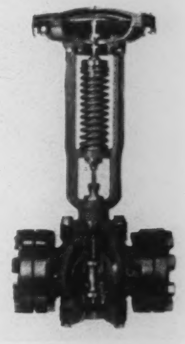


Question: "Don't you people make anything besides that Streamlined Valve you talk about so much?"

Answer: "Yes Sir; we do! And we propose to picture one or two of them here each time."

Cash Standard Type 18245 Reducing Valve handles oil or water under high pressures; maintains constant reduced pressure despite variations at inlet. Bronze body, single seat. Trim is nitralloy or stainless steel. Large T-bar handle adjusts discharge pressure.

Initial pressures to 4000 lbs., reduced pressures 500 to 2500 lbs. Sizes ⅜", ¼", ½", ¾" and 1", all screwed ends.

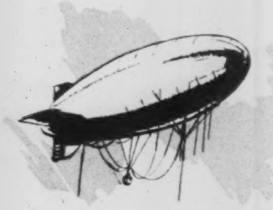


Cash Standard Type 33 Relief Valve; made with diaphragm or piston action, and of various metals to handle nearly all fluids. As indication of the fine mechanism we point to the roller guides for the valve spindle, and the roller bearing which takes care of spring torsion. Sizes ½" to 3" screwed ends, 1" to 12" flanged ends.

☆

Get Free Bulletins on Above . . . Write to
A. W. CASH COMPANY
DECATUR, ILL.

AIR . . . the Warrior !



Air—the magic carpet on which parachuters speed to battle! *Air*—the highway on which great 70 ton bombers roar to the substratosphere! *Air*—the transmission line through which radio's voice flashes! *Air*—that speeds production in countless plants vital to defense!

Yes, AIR is in the thick of the battle on many fronts—fighting, defense, production!

Imagine an entire 50 acre airplane engine plant—completely air conditioned! Well, there it is below—the world's largest. You can bet your boots it's sealed tight against dirt and prying eyes. And that's made possible by flooding the whole 50 acres with clean, comfortable conditioned air—circulated by 161 giant Sturtevant fans.

Then, there's the new Ford engine plant, where intricate engines that are marvels of precision flow from the assembly line like meat from a grinder. Here, to keep efficiency at a high pitch, Sturtevant equipment cleans and circulates 3380 tons of air per hour.

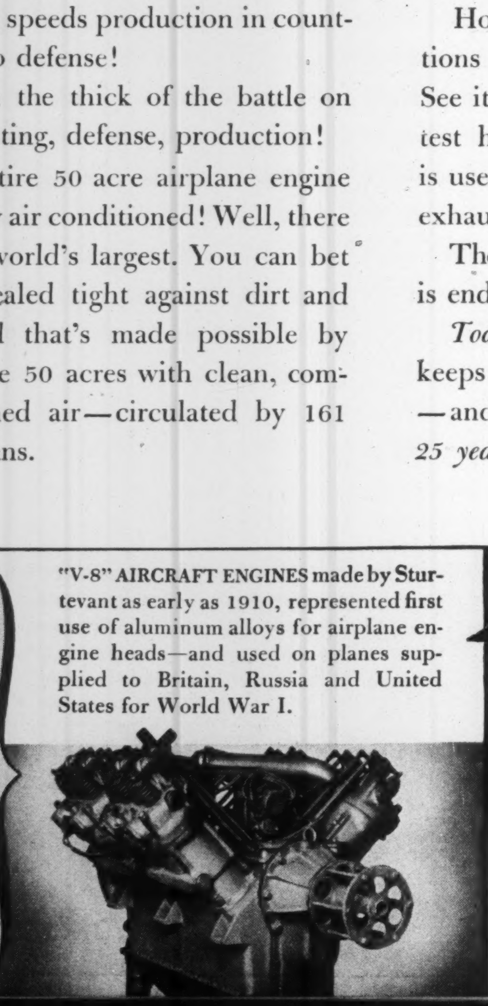
How about simulating actual flight conditions *on the ground?* Impossible? Not at all! See it in the famous Pratt & Whitney Engine test house—where Sturtevant air equipment is used for this purpose and to carry off lethal exhaust fumes.

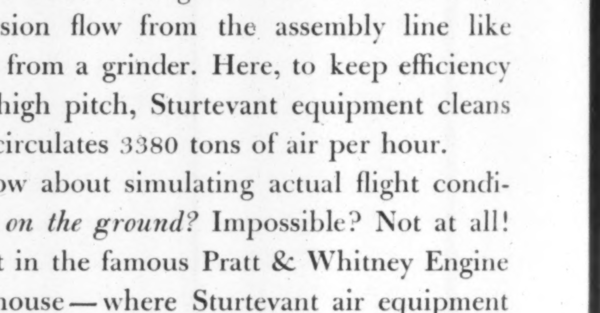
These are merely typical examples. The list is endless.

Today—Sturtevant air handling equipment keeps airplane and engine plants humming—and ventilates and heats giant bombers. *25 years ago*—Sturtevant designed and built

Sturtevant
REG. U. S. PAT. OFF.
Puts Air to Work
in the
Aviation Industry

"V-8" AIRCRAFT ENGINES made by Sturtevant as early as 1910, represented first use of aluminum alloys for airplane engine heads—and used on planes supplied to Britain, Russia and United States for World War I.





STURTEVANT "SCOUT" OF 1916—designed and built by Sturtevant Aeroplane Company, subsidiary of B. F. Sturtevant Company—the first plane incorporating steel construction and forerunner of today's all-metal planes.

15
10TG
JAMES WITTLIG '41

the first planes to use steel construction. From the pioneer days up to the present time, Sturtevant has conspicuously served the Aviation Industry.

B. F. STURTEVANT COMPANY

Hyde Park, Boston, Mass. *Branches in 40 Cities*

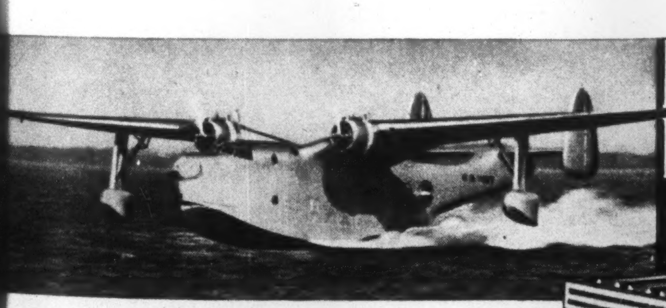
B. F. Sturtevant Company of Canada, Ltd., Galt, Toronto, Montreal

Sturtevant

REG. U. S. PAT. OFF

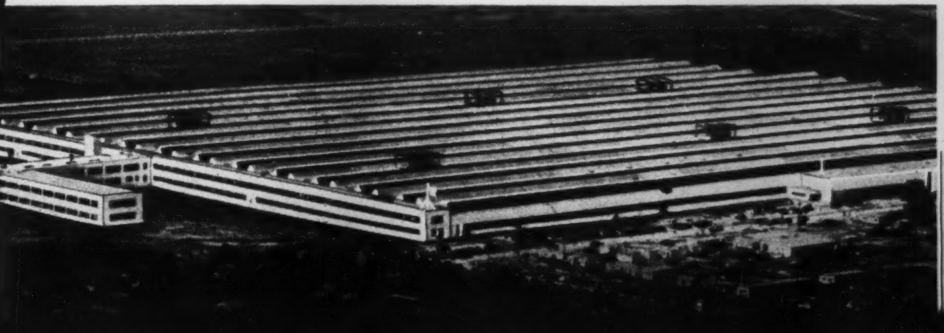
Puts Air to Work

STURTEVANT — FOUNDER OF THE AIR HANDLING INDUSTRY



ONE OF THE MODERN NAVY BOMBERS equipped with Sturtevant heaters and ventilators to maintain desired temperature and air conditions for officers and crew, regardless of outside weather.

50 ACRE, COMPLETELY AIR CONDITIONED Wright Engine plant at Cincinnati, Ohio, where 161 giant Sturtevant Fans circulate more than 7000 tons of air per hour!



QUALITY
TRADE MARK
YOUNGSTOWN
SERVICE

Multiply by 127,272

To make the eleven army cots you see here requires 128 feet of steel tubing, 195 feet of angle steel, 1073 feet of spring wire and 1933 feet of galvanized wire - not to mention rivets and other small pieces of steel.

Multiply these figures for 11 men by 127,272 and you have the amount of steel fabricated into beds for our new army of 1,400,000 men - a total of 451 million feet of material - 33,367 tons of steel.

Such an essential item as beds for soldiers is just one of the many defense uses for which much of the regular production of Youngstown mills is going now. This, of course, is in addition to the ever-increasing tonnage of special steels produced for armament.

Day and night, our plants are working to deliver every ton of steel possible.

25-27D

Youngstown products include Pipe and Tubular Products - Sheets - Plates - Conduit - Bars - Tin Plate - Rods - Wire - Nails - Tie Plates and Spikes

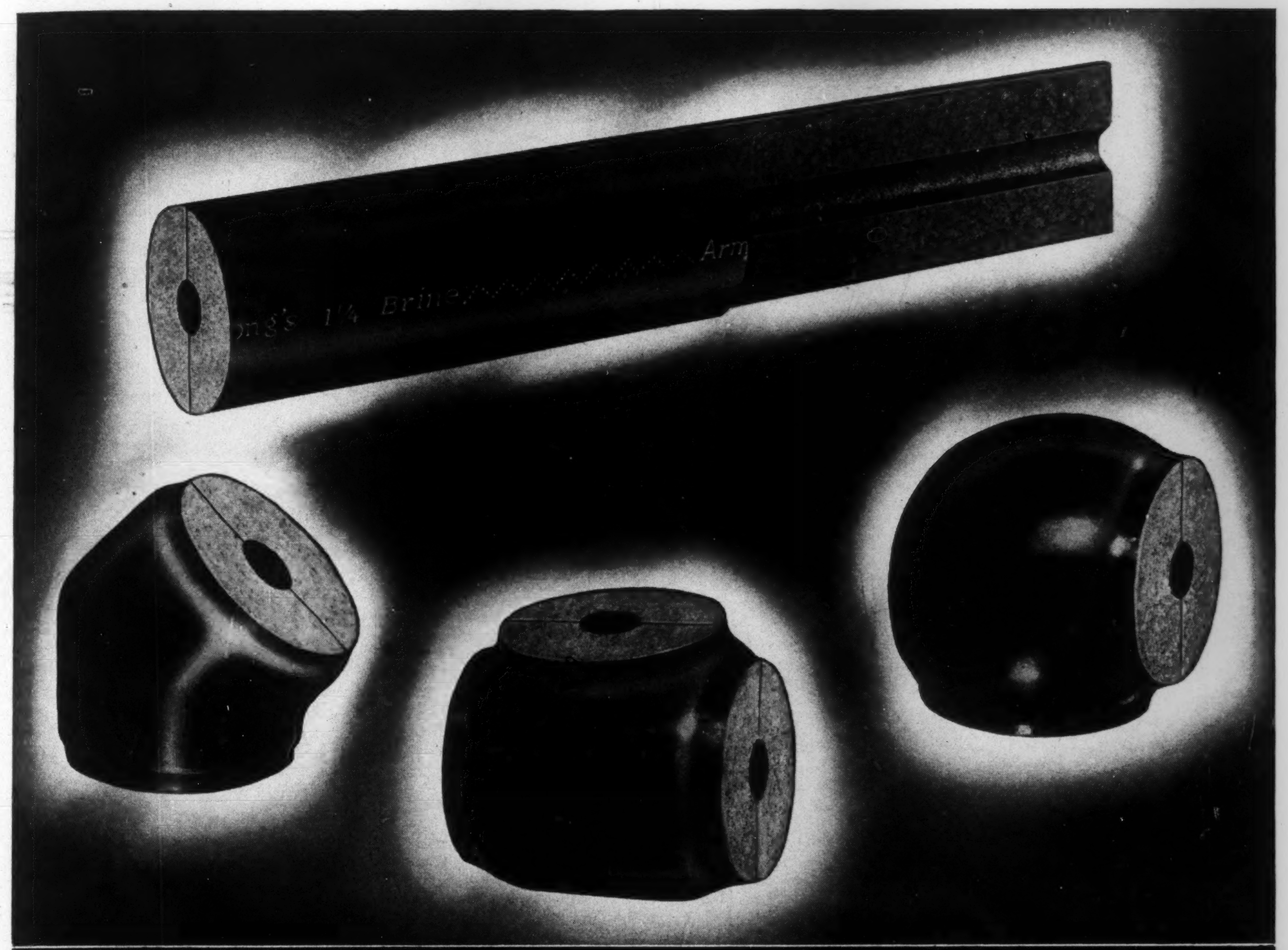
THE

YOUNGSTOWN

SHEET AND TUBE COMPANY

Manufacturers of Carbon, Alloy and Yoloy Steels

General Offices - YOUNGSTOWN, OHIO



HEAT AND MOISTURE BARRED...

when CORK guards cold lines and fittings!

WHEN the job is to deliver refrigeration through cold lines without waste, it's a job for Armstrong's Cork Covering! This efficient, pure CORK material keeps heat *away* from cold lines . . . effectively guards against moisture condensation, too . . . and does it year in and year out!

Armstrong's Cork Covering is furnished in sections 36″ long for straight pipe runs. Three standard thicknesses are made for temperatures down to 25° F. below zero. Special thicknesses are made to insulate lower temperatures and to meet unusually severe conditions.

Every fitting gets the same dependable protection as do straight pipe runs. . . . when CORK is on the job! For Armstrong makes fitting covers in sizes for all standard fittings and in special sizes to order. Fitting covers are molded or machined for a close fit . . . your assurance of tight, moistureproof joints.

You can count on Armstrong's Cork Covering for years of trouble-free, money-saving service. It is strong and rigid, light in weight, highly resistant to all forms of deterioration. Properly installed, it will not sag.

Prompt Delivery

Practically all cork covering is used in plants engaged directly or indirectly in defense work and in plants which require refrigeration to protect perishable foodstuffs. Because of this fact, and because the moderate needs for this insulation have not interfered with the government program of building up a reserve supply of cork, we are able at the present time to fill *all* orders.

We'll be glad to send complete information and engineering data on request. Get in touch with the nearest Armstrong office or distributor, or write to Armstrong Cork Company, 994 Concord St., Lancaster, Pa.

ARMSTRONG CORK COMPANY

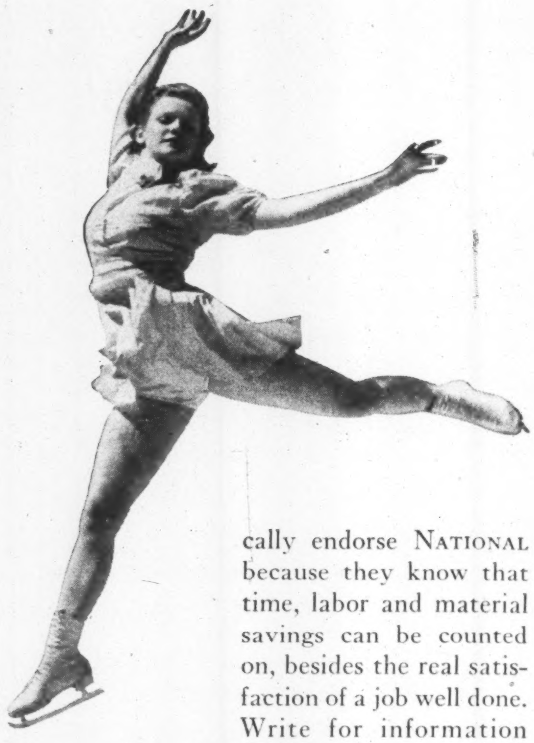
Insulation Headquarters

★ CORKBOARD ★ CORK COVERING ★ FIBERGLAS* ★ TEMLOK ★ INSULATING FIRE BRICK ★

*Reg. U. S. Pat. Off. O.-C. F. Corp.

NATIONAL REFRIGERATION PIPE IS YOUR "BEST BET"

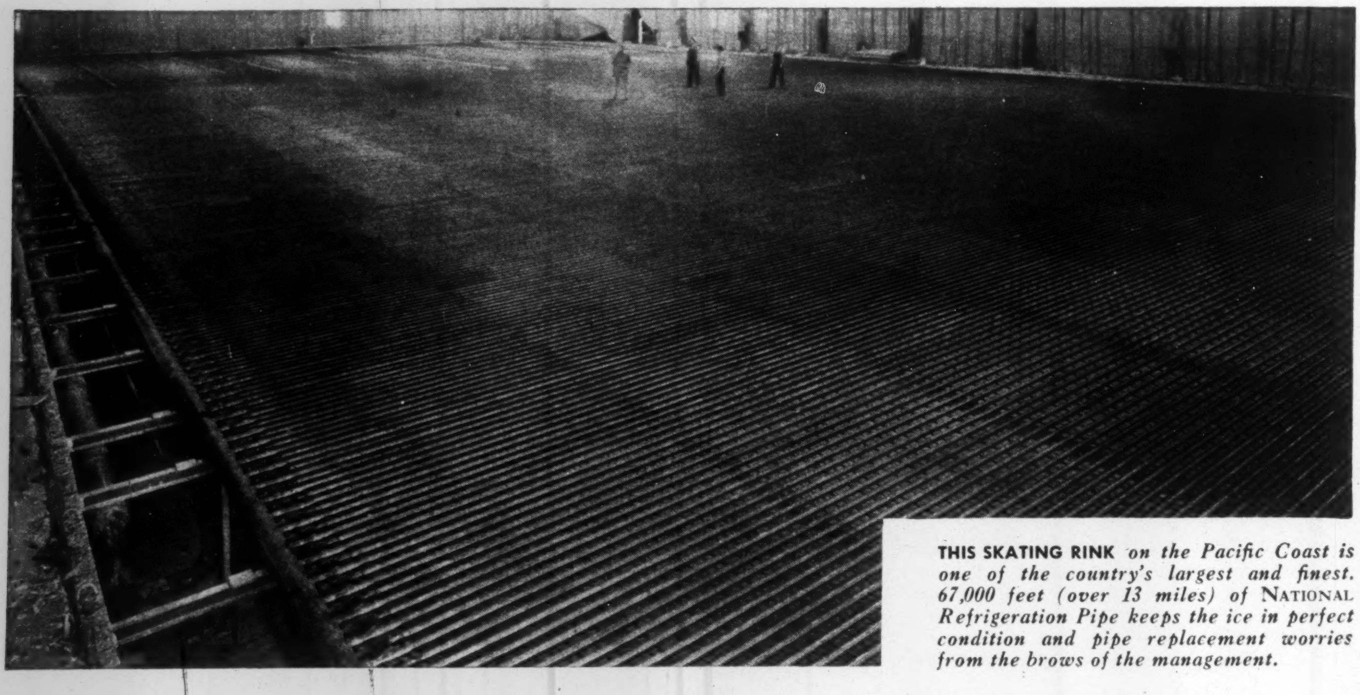
for long life and all-around working qualities



Specifically made for just such service, and tested by thousands of installations — National Refrigeration Pipe, the first choice among builders of ice and refrigeration equipment, has proved a reliable safeguard against premature replacement.

It resists corrosion and is clean, smooth and uniform. One of its most important advantages is its surprising ductility. In many installations where sharp bends must be made, it is bent regularly around small radii without buckling or splitting. Another advantage is its easy welding and threading qualities. Workmen who have welded or coupled thousands of joints, enthusiastically endorse National because they know that time, labor and material savings can be counted on, besides the real satisfaction of a job well done.

Write for information about National Refrigeration Pipe. Ask for Bulletin 5. There is a National distributor in your vicinity.



THIS SKATING RINK *on the Pacific Coast is one of the country's largest and finest. 67,000 feet (over 13 miles) of* National *Refrigeration Pipe keeps the ice in perfect condition and pipe replacement worries from the brows of the management.*

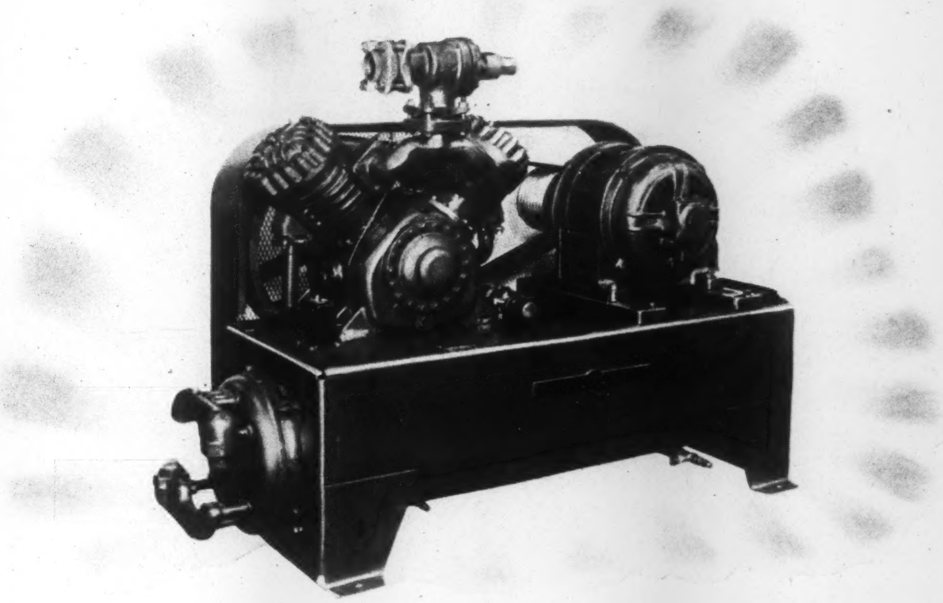
NATIONAL TUBE COMPANY

PITTSBURGH, PA.

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* • United States Steel Export Company, New York

UNITED STATES STEEL

Defense demands reduced costs



CUT INSTALLATION AND SERVICE COSTS WITH

GENERAL ELECTRIC

SCOTCH GIANT

CONDENSING UNITS

Service and installation of refrigeration equipment are simplified with this new line of General Electric *Scotch Giant* condensing units. New efficiencies also result in lower first cost to the consumer.

For instance: New coordinated design of all machines in the line permits the use of many common parts between the various models. Stocking replaceable parts is greatly simplified since two sizes cover the line from 5 to 60 h.p. The chief difference between small and large units is the number of cylinders.

The balanced crank-shaft which requires only two main bearings on the two and four cylinder types helps to insure exceptionally smooth operation . . . Compressors are of three types—two cylinder vertical, four cylinder V, and eight cylinder V.

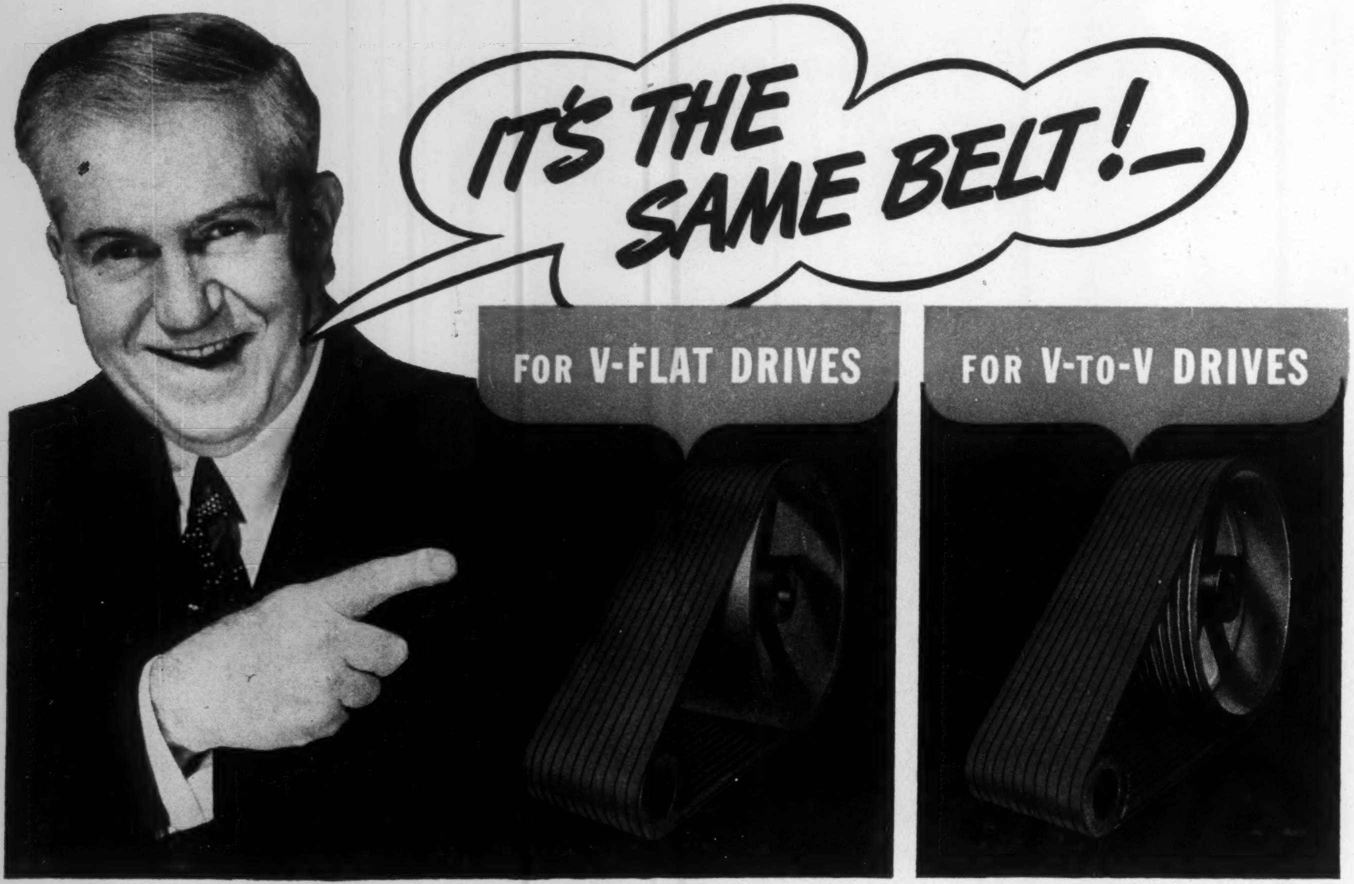
Get this new interesting booklet

Because G-E is throwing its full support behind engineers, architects and contractors, these units (5 h.p. and over) are now sold direct to qualified air conditioning and refrigeration contractors. For complete information, and a copy of the new "*Scotch Giant*" booklet, write to General Electric, Div. 955, Bloomfield, N. J.

GENERAL ELECTRIC

TURN TO

FOR ROOM AIR CONDITIONERS, EVAPORATIVE CONDENSERS DIRECT EXPANSION WATER COILS . . . ALL CENTRAL PLANT AND INDUSTRIAL REFRIGERATION EQUIPMENT



THE NEW Dayton V-BELT

WITH PATENTED FLAT COG CONSTRUCTION

TESTS PROVE: 21% GREATER PULLING POWER
22% LONGER LIFE

Yes, it's the *extra value* V-Belt . . . it's the V-Belt with patented flat cog construction that's built for both V-to-V Drives and V-Flat Drives! Only this new V-Belt has Dayton's non-skid tire tread design to increase traction and pulling power on *flat* pulleys, PLUS Dayton's die-cut raw edges for a more powerful grip on *grooved* pulleys.

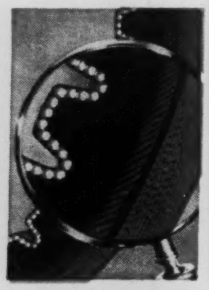
And that isn't all. Only this new Dayton V-Belt has the stronger, heat-resistant Daytex Cord in the neutral axis section—and Dayton's "Built-to-Bend" construction—exclusive features which mean that Daytons run cooler and last longer under the strain of constant high-speed flexing.

Tests prove that this revolutionary V-Belt on flat pulleys of a V-Flat Drive has more than 21% greater pulling power—and laboratory and field tests show that on grooved pulleys this V-Belt has an overall increased life of at least 22%.

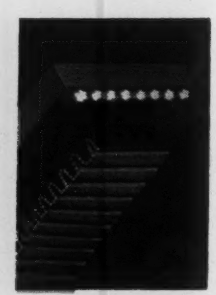
This new V-Belt, with its added performance and unmatched economy, is but another achievement in Dayton's 21 years of V-Belt pioneering. *Yet it costs no more!* Write for complete information and engineering data.

The Dayton Rubber
MANUFACTURING COMPANY, DAYTON, OHIO
The World's Largest Manufacturer of V-Belts
DAYTON, THE GREATEST NAME IN V-BELTS

BUILT-TO-BEND FEATURE AND DAYTEX CORD mean longer life under constant high-speed flexing.



FLAT COGS AND DIE-CUT SIDES provide greater gripping power on grooved pulleys and on flat pulleys.



CROSSWISE RIGIDITY prevents distortion—assures maximum efficiency and longer belt life.

Dayton
V-BELTS
WITH PATENTED COG CONSTRUCTION
THE SAME BELT FOR V-FLAT DRIVES
FOR V-TO-V DRIVES

Copyright, 1941, The Dayton Rubber Mfg. Co.

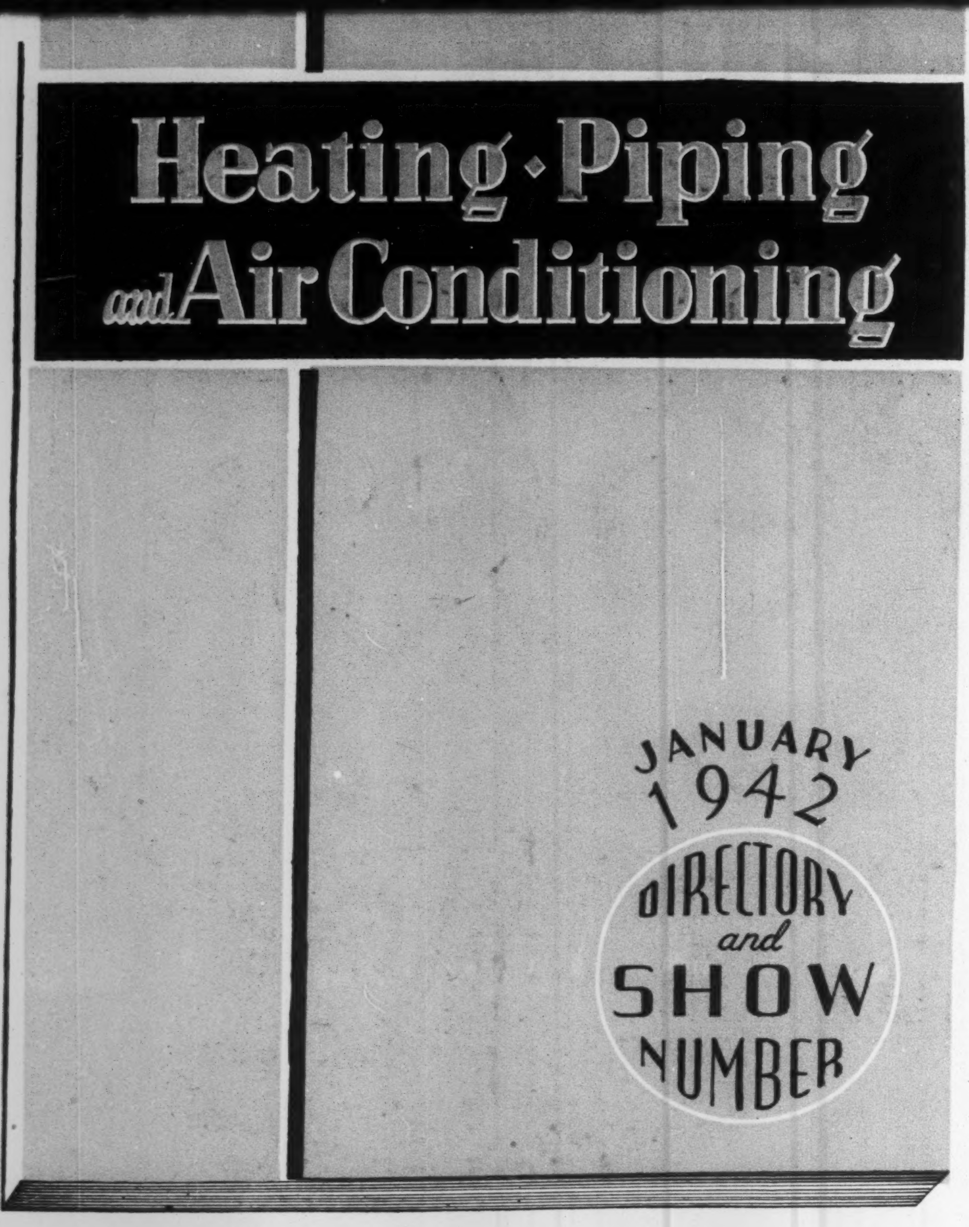
Schools and Colleges
Rely on
Sylphon *Modulating* Control

Architects and engineers acclaim Sylphon Regulators for control of almost any type system from direct radiation to year-'round air conditioning. Schools and colleges, especially, need the *modulating* action of sensitive Sylphon Controls . . . to maintain constant, ideal, healthful temperature. Whether used on individual radiators, zone control or duct-type heating and ventilating systems, these rugged, self-powered controls are extremely simple in operation, widely adaptable to practically every installation problem.

For help in planning your heating and ventilating systems with fully automatic modulating control, call on Fulton Sylphon. Write for Bulletin XE-821.

FULTON
Sylphon
TRADE MARK
FOR
TEMPERATURE
CONTROL

THE FULTON SYLPHON CO.
KNOXVILLE, TENNESSEE
Representatives in All Principal Cities in U. S. A. and in Montreal, Canada and London, England


Heating·Piping and Air Conditioning
JANUARY 1942
DIRECTORY and SHOW NUMBER

COMING NEXT MONTH

• • •

The JANUARY 1942 ANNUAL DIRECTORY and SHOW NUMBER

Send us your reservation today!

AS A DIRECTORY . . . The most complete information on, Who makes it, where to find them, trade names and products they signify and complete manufacturer's address.

AS A SHOW NUMBER . . . Complete listing of all exhibitors at the show. What they'll display and where to locate them.

AS A JANUARY ISSUE . . . The usual quota of technical articles on heating, piping and air conditioning and the Journal Section of the American Society of Heating & Ventilating Engineers.

IT'LL BE OUT next month! HEATING-PIPING AND AIR CONDITIONING'S Eighth Annual Directory and Show Number carrying the industry's original, reliable, complete classifications of "who makes it" and "where are they located?" . . . In addition, it will contain the Show Section of the International Heating and Ventilating Exposition at Philadelphia, complete with all listings and directions of what is to be displayed at the Show and where to find it. It's a real advertising buy for every manufacturer. It offers advertising that lives *all year.* A chance to reach the 10,000 readers and BUYERS with a message that packs a full-year advertising campaign wallop . . . *and at the regular issue rates!*

The smart manufacturer can take advantage of this outstanding service by making a full showing of all products in large space without paying a premium. It's nothing to overlook! 10,000 key dealers, contractors, engineers, wholesalers and manufacturers aren't so easily available in any other way.

An early order will assure you of a good position . . . and you'd better hurry, because time is short!

Heating-Piping and Air Conditioning
6 North Michigan Avenue Chicago, Illinois

FOR EFFICIENT DUST REMOVAL from Large Volumes of Air at Low Cost—

Specify

STAYNEW AUTOMATIC FILTERS

U. S. Government tests* show Staynew Automatic Filters to operate at efficiencies only 2% less than 14 oz. wool felt. Yet, despite this amazing performance, Staynew Automatics are *unsurpassed* in economy of operation. Due to the automatic cleaning of the filter curtains, servicing is reduced to occasional withdrawal of the sludge and maintenance of oil level—not oftener than once every 6 mos. in most installations. Power consumption, also, is reduced to a minimum. To illustrate, a large Rochester, N. Y., dept. store averaged only 4c per day for electric power to filter 130,000 cfm.

**Dept. of Commerce, National Bureau of Standards*

A "FOUR-BAGGER" IN FEATURES

1. *Two* Endless Filter Curtains: second does not enter oil bath and collects any tiny particles of oil from first, or wet curtain. Exclusive.

2. Pneumatic Brushes: air jet cleaners "brush off" excess oil from both curtains, maintaining constant efficiency and preventing oil entrainment. Exclusive.

3. Counter-Clockwise Curtain Movement: outlet side always clean side. Exclusive.

4. Mesh-like Smooth Screen Metallic Curtain: possesses sufficient capillary tension to hold oil film, yet quickly releases dust and lint in oil bath. Exclusive.

Get the Entire Story in New
44 PAGE CATALOG
Catalog describes entire line, including filters for air lines, engines, liquid lines.

STAYNEW FILTER CORP.
9 Leighton Ave. Rochester, N. Y.

PROTECTOMOTOR 99 9/10 Per Cent Efficient AIR FILTERS *"Filter Headquarters"*

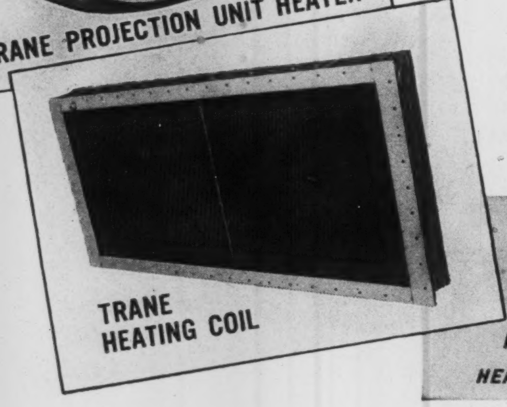
WRIGHT AERO CORP

TRANE

provides correct air for airplane engine testing

TRANE CLIMATE CHANGER

TRANE PROJECTION UNIT HEATER


TRANE HEATING COIL

THERE are few, if any, jobs more important in the country today than the manufacture of engines for the aircraft which guard America. One of the most important factors in this field is the Wright Aeronautical Corporation of Paterson, New Jersey, manufacturers of the famed "Cyclone" engines.

After assembly, the Wright engine is immediately placed in what are known as "test cells" where the engine is operated and tested to insure perfection in every detail. A standard fixed temperature greatly simplifies this procedure and facilitates uniform testing. This is accomplished by the use of an arrangement consisting of two rows of Trane Steam Heating Coils and four rows of Trane Water Cooling Coils. In addition, over forty Trane Climate Changers are used for heating, cooling and ventilating the operators' rooms which are located between each pair of test cells.

To the architects, engineers, contractors, builders and industrials of America who are combining their efforts to further the national defense program, Trane has this message: We have the products, the knowledge, the production facilities and the nation-wide representation which you need to assist in the solution of your heating, cooling and air conditioning problems of every description.

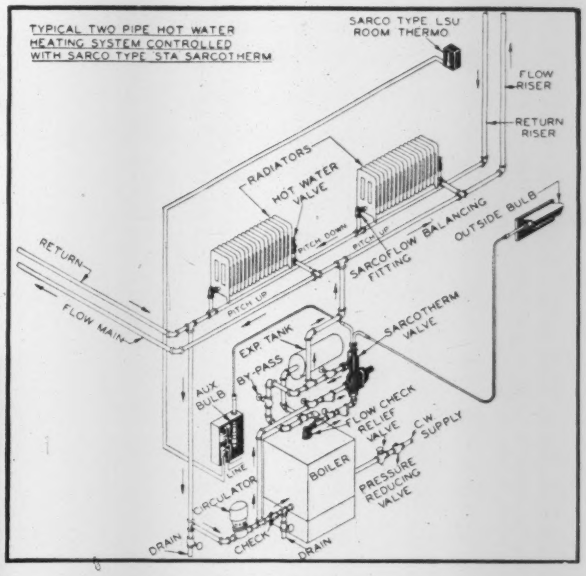
THE TRANE COMPANY

LA CROSSE, (AIR) WISCONSIN

Also TRANE COMPANY OF CANADA, LTD. • TORONTO, ONTARIO

HEATING • COOLING • AIR CONDITIONING EQUIPMENT FROM 85 OFFICES

MODERNIZED *with*


TYPICAL TWO PIPE HOT WATER HEATING SYSTEM CONTROLLED WITH SARCO TYPE STA SARCOTHERM
SARCO TYPE LSU ROOM THERMO
FLOW RISER
RETURN RISER
RADIATORS
HOT WATER VALVE
PITCH DOWN
PITCH UP
SARCOFLOW BALANCING FITTING
OUTSIDE BULB
RETURN
FLOW MAIN
PITCH UP
SARCOTHERM VALVE
EXP. TANK
BY-PASS
AUX BULB
FLOW CHECK
RELIEF VALVE
C.W. SUPPLY
LINE
BOILER
PRESSURE REDUCING VALVE
CIRCULATOR
DRAIN
CHECK
DRAIN

SARCOTHERM
HOT WATER CONTROL

Saved 12% in fuel costs—

Sarcotherm gives new life to old hot water heating systems. It is a simple form of modulated control accomplished by blending a varying portion of the boiler water with the return, while Sarcoflow fittings balance the system.

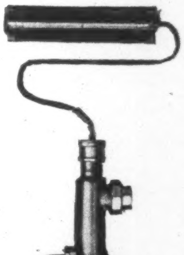
Less boiler strain because boiler is operated at constant temperature. Controlled by outside temperature. High radiator temperatures in cold seasons—no overheating in mild weather. Sarcotherm saves fuel and provides de luxe temperature control for hot water heating systems.

Here are some of the results—

An apartment saved 12.2% on fuel cost.

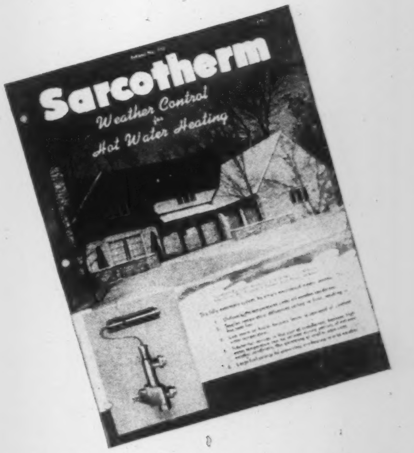
A home showed a saving of 12.4%.

A single Federal Housing Project has 35 Sarcotherms.



It is ideal for split systems and for zone control.

Architects and owners alike appreciate the perfection of control regardless of outside temperatures. It's a luxury that repays its cost in fuel savings—and makes friends, all around.


Sarcotherm
Weather Control for Hot Water Heating

Ask for Sarco Catalog No. 175. Diagrams, hook-ups, equipment and illustrations of Sarcotherm in service in apartments, factories and homes.

SARCO COMPANY, INC. • 475 FIFTH AVENUE • NEW YORK, N. Y.
SARCO CANADA LTD., 85 RICHMOND ST. W., TORONTO, ONT.

133

HE CALLED FOR HELP AND HE'S GETTING IT

FROM NOT 1 BUT 5

—How Taylor is helping not 1 but 5 essential industries help Uncle Sam

EVERY INDUSTRY in America has buckled down to the job of helping build up U. S. defense. Every American industry is an essential industry today. *Your* production is *essential* production. Uncle Sam needs your help. He can't be prepared without it.

In thousands of plants and factories—in all *essential* industries—Taylor Instruments are right on the job. Just to illustrate how Taylor is helping, consider five—*not 1 but 5*—industries.

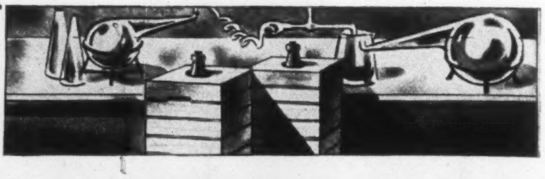
Chemicals, metals, petroleum, power, and rubber are vital needs of this nation. The chemical industry has stepped up its wonder-working. Familiar chemicals are being produced faster. Better chemicals in larger quantities are being turned out. New chemicals are appearing. The chemical industry has always depended on Taylor precision.

Without metals, there could be no defense. Metals are basic. Over the highly complicated, exact processes of metal-working, Taylor Instruments stand quality guard. Petroleum and its allied products must fuel America's fighting machines. More petroleum, better petroleum must be made available faster. In all refining operations, in all the great producing areas, Taylor Instruments are helping oil men.

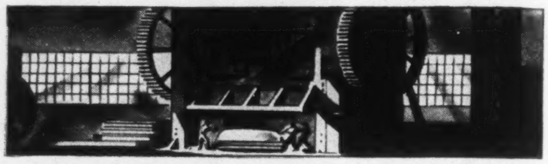
Power—unlimited, uninterrupted power—must run America's humming factories. Taylor Instruments help produce that power economically. Uncle Sam needs rubber—needs it for a million jobs. Taylor Instruments have helped make the increased production of finer rubber an almost 100% automatic operation.

For a good many years, Taylor and all American Industry have been partners in precise production. Taylor has learned a whole lot from this work together. What we've learned is yours to use. If any experience, any special skills of Taylor Instrument Companies will help solve your particular production or processing problems → or help you get better service from your present instruments—please call us. There are no strings to this offer. Taylor Instrument Companies, Rochester, N. Y. Also Toronto, Canada.

CHEMICALS



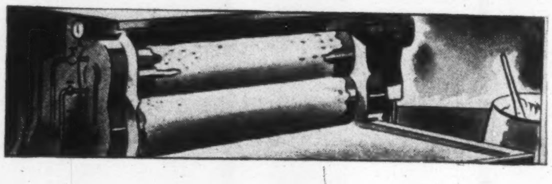
METALS

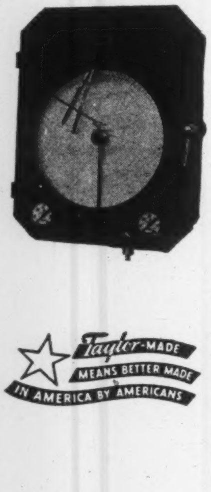


PETROLEUM

POWER

RUBBER





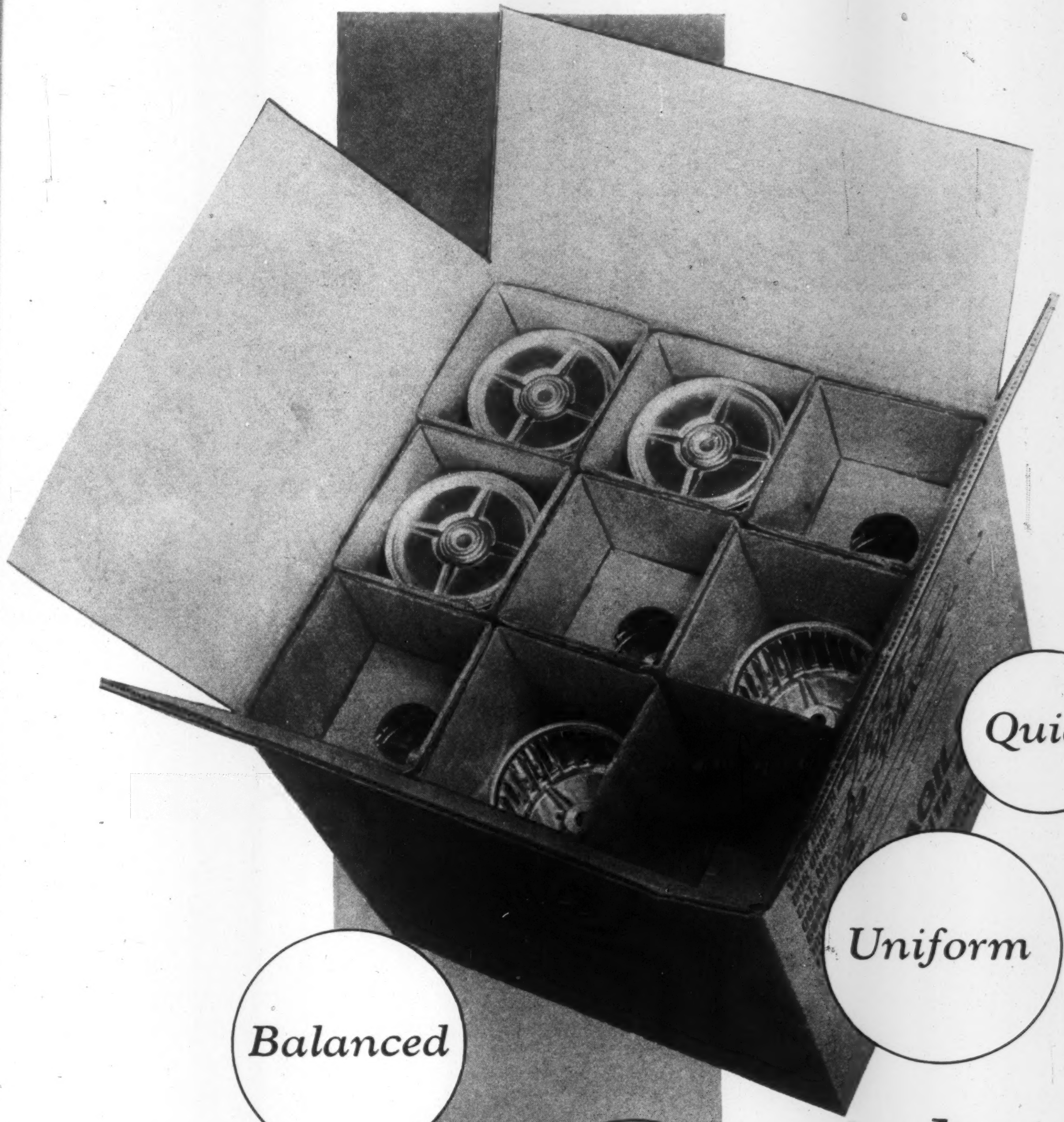
The New Taylor Fulscope Controller Protecting America's Production with Not 1 but 5 Forms of Control

Taylor-MADE MEANS BETTER MADE IN AMERICA BY AMERICANS

Taylor

Indicating Recording Controlling

TEMPERATURE, PRESSURE, FLOW *and* LEVEL INSTRUMENTS



. . . when delivered!

Care in manufacture must not be nullified by damage in transit. Specially designed packing materials protect all Torrington air impellers during shipment. We build into every *Airotor* Blower Wheel and *Airistocrat* Fan Blade qualities every manufacturer wants. We back them by guaranteed performance ratings, then protect them en route.

Write for your catalog today!

TORRINGTON

MANUFACTURING COMPANY, TORRINGTON, CONN.

A LEADING QUESTION ON VENTILATION EFFICIENCY

"How will the fan perform after it's installed"?

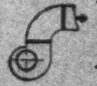
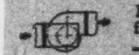
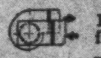
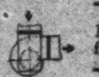
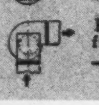
FOR PRACTICAL ON-THE-JOB EFFICIENCY

Specify THE NEW IMPROVED "Buffalo" TYPE "LL" Limit-Load FAN

REG. U.S. PAT. OFF.

There's one thing you can be certain of with the new, improved Buffalo Type "LL" Limit-Load Fans—they measure up to standard code ratings, not only "on paper" but on the job. These fans are practical—just glance at the chart of performance tests to the right. Yes, the improved Buffalo design exceeds expectations "on the job"—where average installation conditions impose obstructions . . . Here's something really new in ventilating fan engineering—something worth getting acquainted with right NOW. Write for new Bulletin 3339.

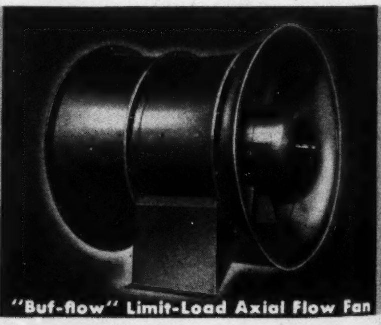
• The data below are based on a fan outlet velocity of 1600 feet per minute. The obstructions tested represent conditions of actual installations.

			Percent Reduction in Capacity	
	Obstruction	Static Pressure	Buffalo Type "LL"	Competitive Forward Curve
	Elbow on Fan outlet	1" ¾" ½"	3% 3% 3½%	7% 7% 11%
	Elbow on inlet from left side	1" ¾" ½"	2½% 2% 3%	8½% 11% 17½%
	Elbow on inlet from right side	1" ¾" ½"	1½% 1½% 2½%	5% 6% 7%
	Elbow on inlet from top	1" ¾" ½"	2½% 2% 3%	5% 6% 7%
	Elbow on inlet from bottom	1" ¾" ½"	1½% 1½% 2½%	5% 6% 7%

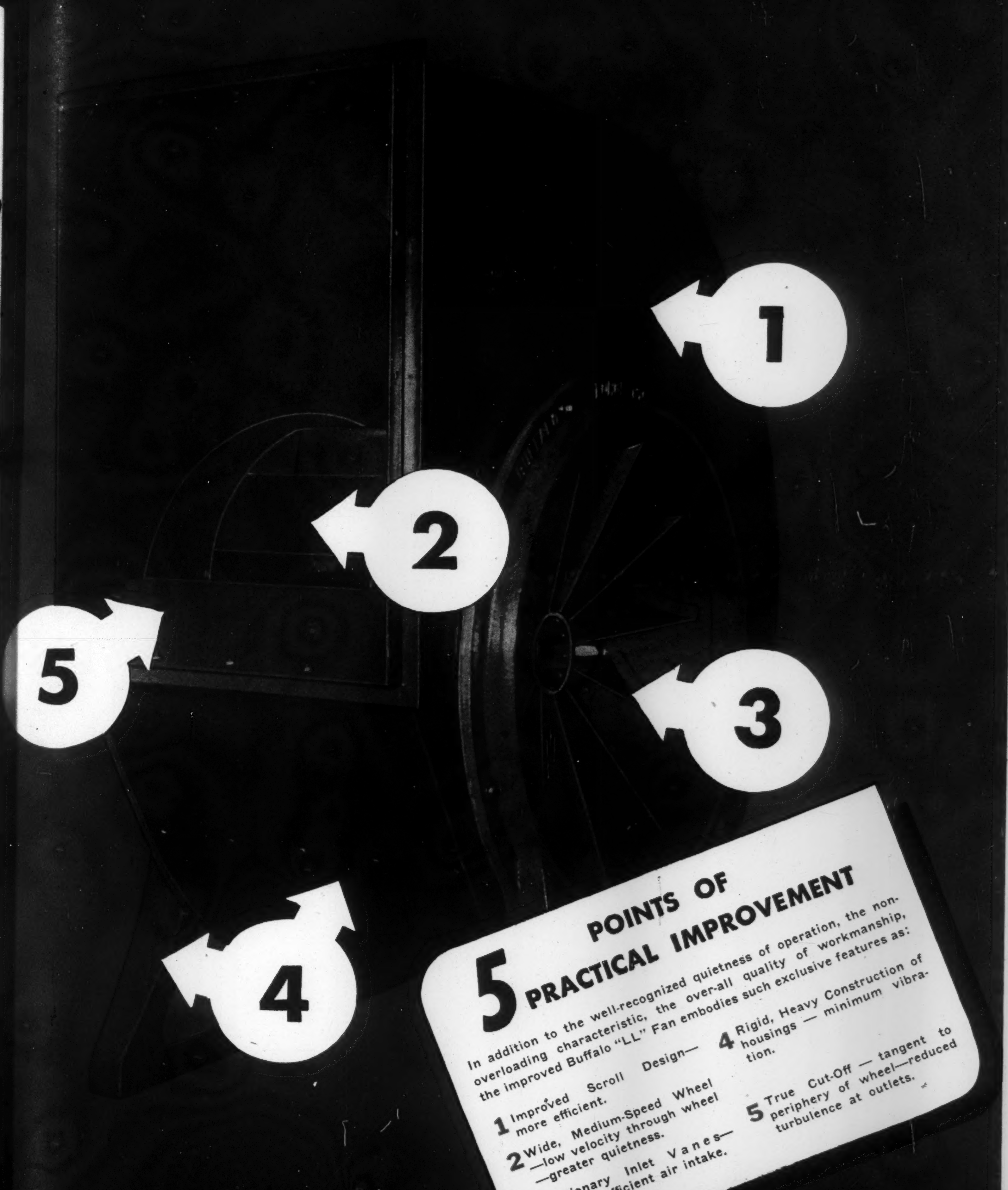
Buffalo Breezo-Fin Unit Heater

Other Buffalo Equipment

Remember—there is Buffalo Fan equipment for every industrial and commercial service—also, cooling, heating and air conditioning equipment. Let Buffalo Branch Engineering Offices serve you.



"Buf-flow" Limit-Load Axial Flow Fan



5 POINTS OF PRACTICAL IMPROVEMENT

In addition to the well-recognized quietness of operation, the non-overloading characteristic, the over-all quality of workmanship, the improved Buffalo "LL" Fan embodies such exclusive features as:

1 Improved Scroll Design—more efficient.

2 Wide, Medium-Speed Wheel —low velocity through wheel —greater quietness.

3 Stationary Inlet Vanes—smooth, efficient air intake.

4 Rigid, Heavy Construction of housings — minimum vibration.

5 True Cut-Off — tangent to periphery of wheel—reduced turbulence at outlets.

COMPANY 171 MORTIMER ST., BUFFALO, N. Y.
Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Strain and speed are hardest to handle *at the turns* in PIPING, too!

THE DANGER LIES AT THE TURNS
USA I

On a bobsled run, constant danger lies at the banked turns. Here the utmost skill of the driver and braker are required to avert an accident. (*I.N.S. photo*).

Insure safer, stronger, trouble-free piping systems with TUBE-TURN welding fittings

When the fluids or gases in your piping systems zoom through the lines and swerve into the turns—*added* strain and friction strike the fittings and joints. Trouble usually develops here *first* in any piping system *because the most danger lies at the turns!*

Weld with TUBE-TURN fittings and *your* plant piping systems will last far longer, function more efficiently and safely, save valuable space, and cut upkeep costs.

There is a TUBE-TURN for *every change in flow direction*—elbows, returns, tees, reducers, laterals, nipples and flanges—made with Tube-Turns' exclusive forging process to give unequalled reinforcement at these danger spots.

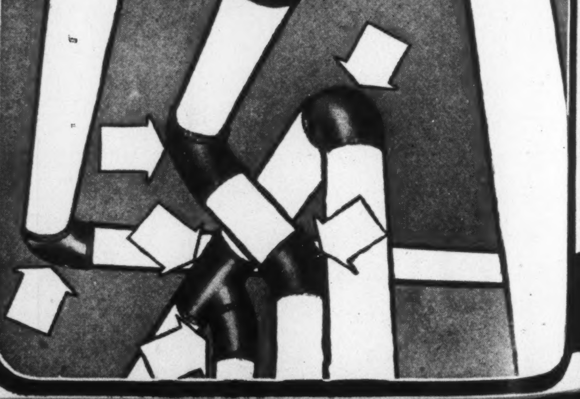
Get complete facts in the helpful Tube-Turn engineering data book and catalog. Write today!

TUBE-TURNS, Inc., Louisville, Ky. *Branch offices:* New York, Philadelphia, Chicago, Pittsburgh, Cleveland, Tulsa, Los Angeles. *Distributors everywhere.*

TUBE-TURN
TRADE MARK
Welding The FIRST WELDING FITTINGS 1ST AND STILL THE BEST *Fittings*

WELDING WITH TUBE-TURNS REMOVES "DANGER AT THE TURNS" IN PIPING

When you think of "turns" in piping systems, remember they occur within tees, reducers, laterals, nipples, heads, etc., as well as within elbows and returns. Wherever there are abrupt *changes in flow direction* you'll find *extra* wear and tear. TUBE-TURN welding fittings provide maximum *extra* strength and safety, and practically eliminate maintenance troubles, at these *danger spots.*



STEAM Heats America . . . .

©1940

TODAY'S OPPORTUNITY: HEATING MODERNIZATION

In existing buildings of almost every type, the fuel-saving Webster Moderator System has solved the problem of tenant discomfort and wasteful heating. The cooperation and service of the Webster Organization are freely offered to help you pre-determine the amount of savings possible with Webster Heating Modernization Programs. Address: Warren Webster & Company, Camden, N. J.

OWNERS SAVE STEAM WHILE TENANTS GET HEATING COMFORT

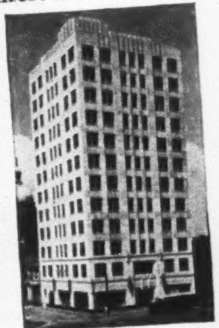
Webster Moderator System Gives Heating Satisfaction in Harrisburg Building

DESIRED HEAT IN EVERY ROOM

Economy Results from Delivery of Steam According to the Need for Heat

Harrisburg, Pa.—The 12-story State Street Office Building is achieving the apparently conflicting objectives of comfort and economy as the result of installing a Webster Moderator System of Steam Heating in 1937.

Better heating results from delivery of steam according to need.


State Street Office Bldg., Harrisburg, Pa.

Between May, 1938, and April, 1940, the Building required 5,800,000 lbs. of steam for heating. This represents 360 lbs. of steam per sq. ft. of radiation per season or .0666 lbs. of steam per sq. ft. of radiation per degree day—very economical operation for buildings of this type.

As a part of the installation, 202 radiators were equipped with Webster Radiator Supply Valves and Thermostatic Radiator Traps.

Herre Brothers, of Harrisburg, made the heating installation. There is a total of 8,050 square feet of installed direct radiation.

The State Street Office Building was designed by William Lynch Murray, Harrisburg architect. It is owned by the Payne-Shoemaker Company. Charles S. Urich is Building Manager. Steam is supplied from the mains of the Pennsylvania Power & Light Co.

Facing the Building is the Pennsylvania State Capitol Group, where five Webster Moderator Systems provide comfort for state employees and substantial steam savings.

VILLANOVA COLLEGE SOLVES PROBLEM OF HEAT DISTRIBUTION

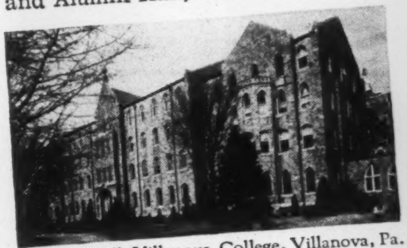
Webster Moderator System Makes Possible 25-30% Reduction in Annual Steam Consumption

CUTS COSTLY WINDOW OPENING

Steam Delivery to Radiators is Adjusted Automatically by Outdoor Thermostats

Villanova, Pa.—Villanova College, one of America's leading Catholic educational institutions, solved the heating problem in three College buildings by installing Webster Moderator Systems in 1940.

The buildings are Mendel Hall, including a dormitory, classrooms and administrative offices; Fedigan Hall and Alumni Hall, both dormitories.


Mendel Hall, Villanova College, Villanova, Pa.

"We are satisfied that we have found the ideal method of heat control for school or college buildings," says John Lawson, Controller. "We are getting exactly the temperatures we want at a saving of 25 to 30 per cent in steam consumption.

"We are particularly pleased with the control of steam delivery by the Webster Outdoor Thermostat feature of the Moderator System. This makes the heating of each of our buildings independent of window opening, saves steam."

The Superintendent of Buildings and Grounds is responsible for the well-planned operating schedule which assures maximum comfort from the Webster Systems.

Galligan Brothers, of Philadelphia, acted as modernization heating contractors.

The heating of two more Villanova College buildings was brought up-to-date in 1941 with Webster Moderator Systems.

HOME OF ROCHESTER DEMOCRAT-CHRONICLE CUTS HEATING COSTS

Webster Moderator System Helps 5-Story Newspaper Building to Save $738 in 6 Months

INCREASES HEATING COMFORT

Satisfactory Heating Provided in all Sections, including Press Room and Offices

Rochester, N. Y.—Heating costs in the Democrat and Chronicle Building were reduced $738.80 in the first six months after completion of a Webster Heating Modernization Program.

This substantial saving is a result of the improved steam distribution secured with a Webster Moderator System of Steam Heating.

Democrat and Chronicle Building
Rochester, N. Y.

Neal Murphy, Business Manager of the Democrat-Chronicle, one of the famous Gannett newspapers, says:

"During the four years previous to heating modernization, we required 410.1 lbs. of steam per degree day to heat our building. With the Webster Moderator System, we require only 240 lbs. of steam per degree day and we are getting much better heat distribution.

"Our experience here has led the Gannett Company to install the Webster Moderator System in our Utica Observer-Dispatch Building, Utica, New York."

The Democrat and Chronicle Building is heated by steam from the street mains of the Rochester Gas & Electric Company. The savings are based on the difference between present and past steam consumption.

In every section of the building—mechanical department, pressroom and offices—comfort has been increased. There is a total of 3,323 square feet of installed direct radiation.

Seven important services protected with

BYERS WROUGHT IRON

Public buildings have long been a proving ground for wrought iron's ability to minimize repairs and maintenance. A customs house got 73 years of service out of a wrought iron heating system. In a mid-western hospital, hot and cold water lines of GWI were still in service, after 81 years. In an eastern government building, fire, soil, waste, vent and leader lines of wrought iron were found to be in excellent condition after well over 40 years of service. Today, when the cost of future repairs and the ability to make them are both unpredictable quantities, records like this take on even greater significance.

In the Criminal Courts Building and Jail recently completed in New York City, the architects and engineers made good use of corrosion-resisting wrought iron. It was specified for all soil, waste, vent and leader lines in the building and basement; chilled water lines in the air conditioning system; heating returns and connections; and all steam supply lines, except in the basement.

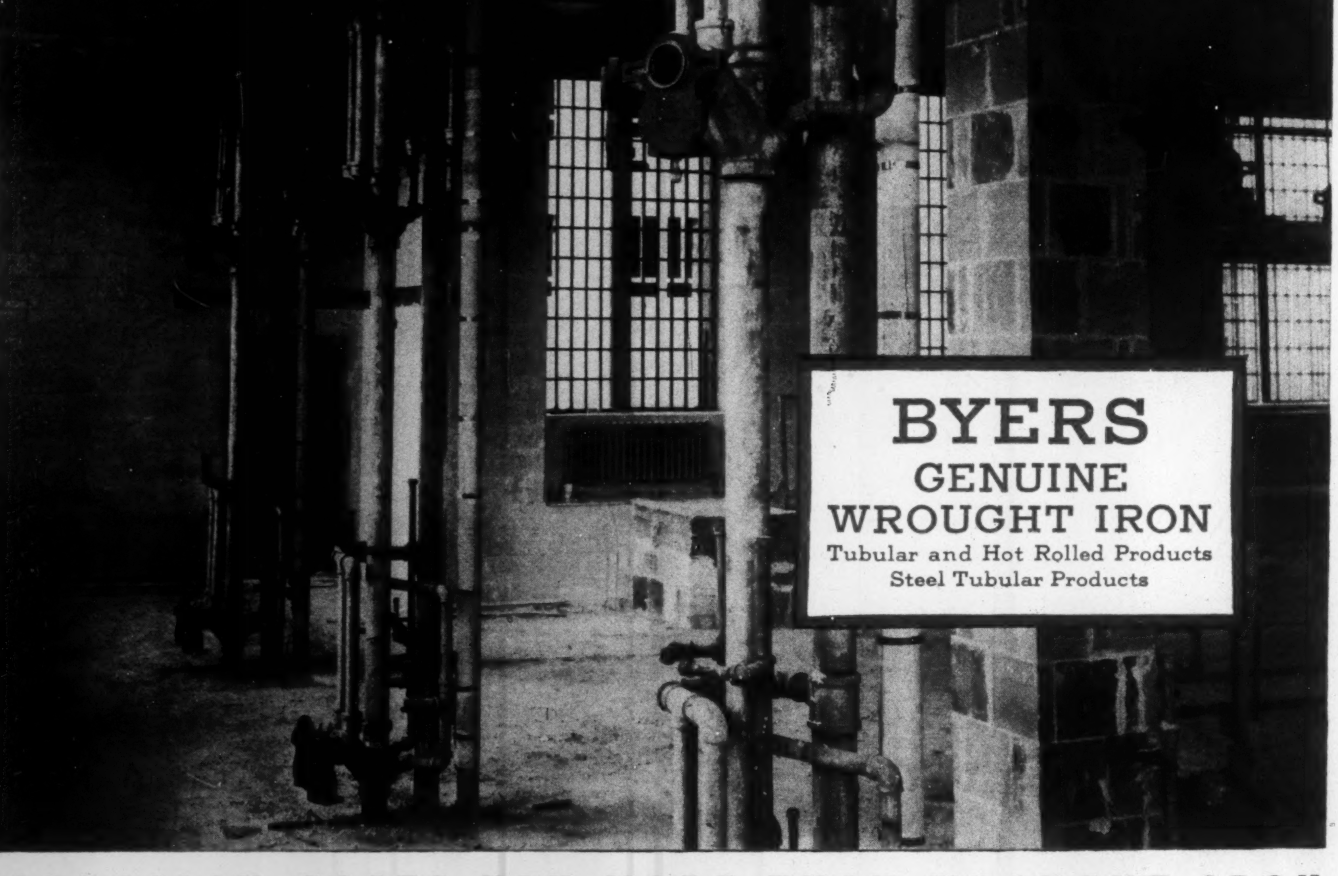
Our Engineering Service Department can help you simplify the job of writing specifications. We have authentic records of wrought iron's performance in similar applications, and under similar conditions, which provide the safest and most dependable guide. Our bulletin, "Wrought Iron for Piping Systems," will show you a few of the many places where wrought iron is successfully serving. Would you like a copy?

A. M. Byers Co., Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Chicago, St. Louis, Houston, Seattle, San Francisco.

NEW CRIMINAL COURTS
BUILDING AND JAIL
New York, New York

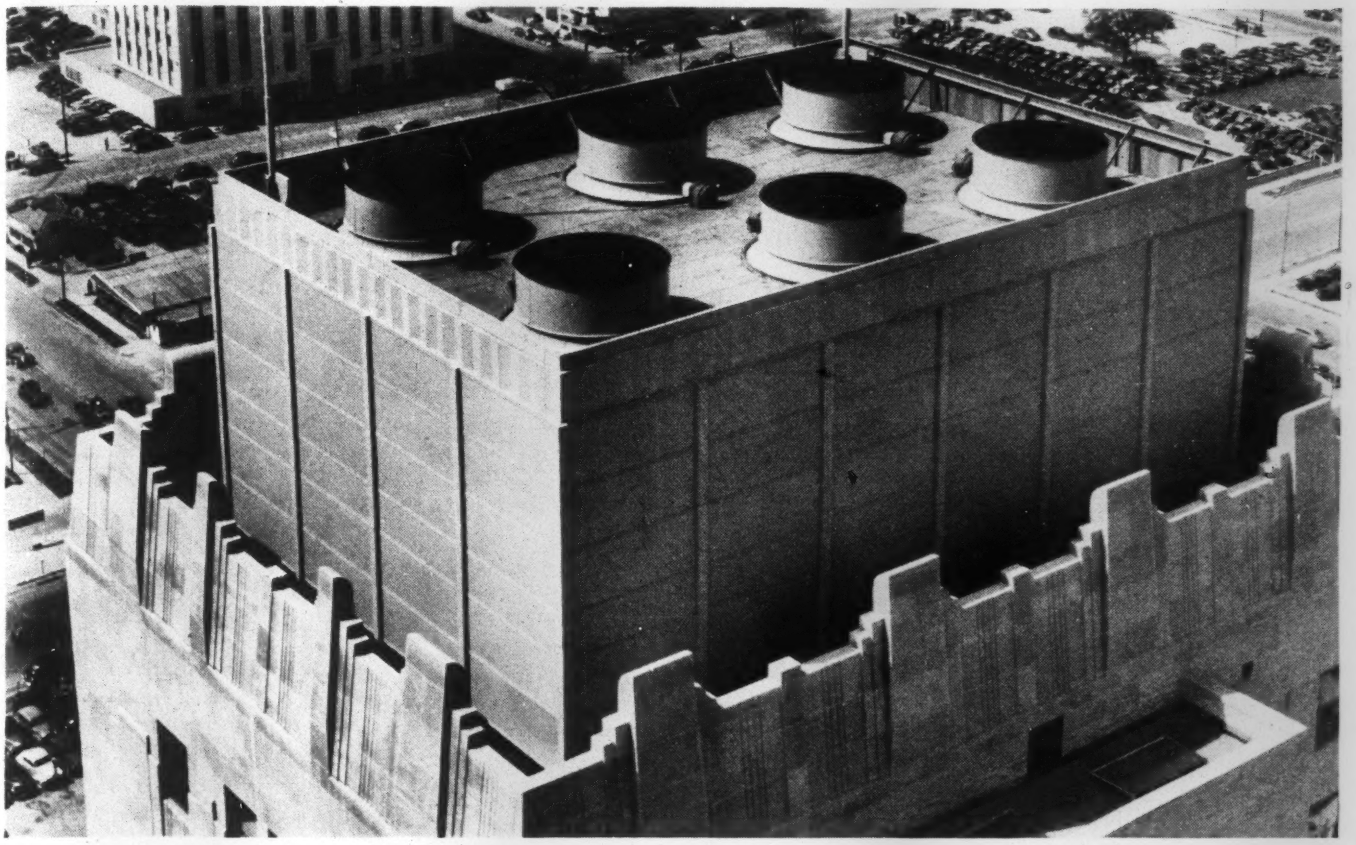
CHARLES B. MEYERS and
HARVEY WILEY CORBETT,
Associate Architects

SYSKA & HENNESSEY
Consulting Engineers. Design and Construction under the supervision of the Department of Public Works, City of New York, Irving V. A. Huie, Commissioner.

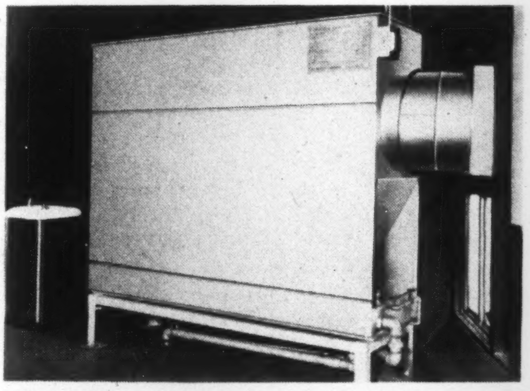


BYERS
GENUINE
WROUGHT IRON
Tubular and Hot Rolled Products
Steel Tubular Products

CORROSION COSTS YOU MORE THAN WROUGHT IRON



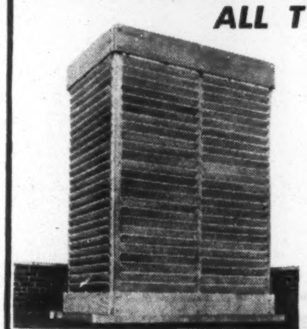
Cooling Towers —VITAL LINKS IN TODAY'S AIR CONDITIONING AND REFRIGERATION SYSTEMS



Today's advanced air conditioning and refrigeration machinery is best assured of maximum efficiency—and the *continued* delivery of maximum efficiency—by a wisely-selected cooling tower.

Marley alone offers such a complete selection of cooling towers that *all* requirements may be met *precisely* and with *utmost economy*. Marley alone offers the services of such a large nation-wide organization, highly trained to advise on specific problems.

Offices in 36 cities or write —



ALL TYPES—ALL SIZES

MECHANICAL DRAFT or NATURAL DRAFT

INDOOR or OUTDOOR INSTALLATION

To Serve 2 Tons and Up Without Limit
under any atmospheric or service conditions

MARLEY COOLING TOWERS

The MARLEY Company, Inc.
Kansas City, Kansas

Also Makers of MARLEY SPRAY NOZZLES for EVERY Spraying Purpose

ONE SOURCE
ONE
RESPONSIBILITY
FOR ALL THREE

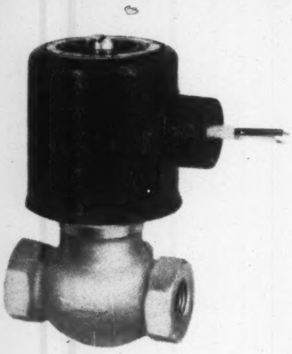
When you use expansion valves, solenoid valves and temperature or pressure controls on an air conditioning or refrigeration job, it is important both to you and to your customer that all three units work together in complete harmony. • There is no question on this point when Detroit valves and controls are installed, because Detroit Lubricator Company is the only manufacturer who can exercise complete supervision over engineering, production and final inspection of all of these units. • In using Detroit valves and controls you have a single source with undivided responsibility—no delays in the assembly of the equipment you need for a given job. It is good business to use Detroit valves and controls.

DETROIT EXPANSION VALVES

No. 673 Thermostatic Expansion Valve

Detroit Expansion Valves are available in either automatic or thermostatic types and in capacities from .035 ton to 20 tons on Freon. Likewise, they are available in either the Dura-Fram single diaphragm or the Duraflex bellows types. All thermostatic valves are gas charged to protect the motor and provide maximum sensitivity. Needles and seats of all Detroit valves are made of hard, corrosion resistant Delubaloy—all have special cast brass bodies for maximum durability. The capacities of all large valves can be readily changed in the field by a simple change of capacitators or seat assemblies.

DETROIT SILENT SOLENOID VALVES



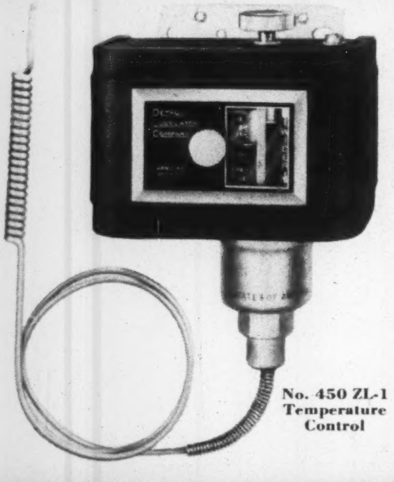
No. 683-3 Solenoid Valve

Detroit Solenoid Valves cover a complete range of capacities up to 17 tons on Freon at a 2 lb. pressure drop. Electric characteristics assure quiet operation—no A. C. hum. Coils are vacuum impregnated to resist moisture. They will not overheat even in continuous service.

A strong kick-off spring eliminates any tendency to stick in the open position and assures tight closure. Plunger and valve seats are non-magnetic.

Detroit Solenoid Valves can be readily disassembled in the field for inspection or cleaning. Coils can be replaced without breaking the refrigerant line.

DETROIT No. 450 TEMPERATURE AND PRESSURE CONTROLS



No. 450 ZL-1 Temperature Control

Detroit all metal No. 450 Controls (full line voltage rating) include both temperature and pressure units for all types of commercial refrigeration and air conditioning. They feature such improvements as moisture proof snap switches, high pressure cut-out, high pressure cut-in, simplified internal or external adjustments, covers either solid or with window and strong, sturdy parts that are readily interchangeable in the field.

DETROIT LUBRICATOR COMPANY

General Offices: DETROIT, MICHIGAN

Canadian Representatives — RAILWAY AND ENGINEERING SPECIALTIES LIMITED, Montreal, Toronto, Winnipeg

Export Representatives: Melchoir, Armstrong, Dessau Co., Ridgefield, New Jersey

The All Purpose

AIR VELOCITY METER

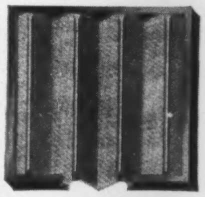
Alnor VELOMETER

INSTANTANEOUS DIRECT READING

ASK FOR BULLETIN 2448D

Illinois Testing Laboratories Inc.

419 N. LA SALLE ST., CHICAGO, ILL.



INDUSTRIAL AIR CONDITIONING Needs SOMERS HAIR GLASS FILTERS

SOMERS HAIR GLASS FILTER "V" type

Somers Filters are built with frames of galvanized metal, packed with Hair Spun Glass — washable — odorless — non-absorptive—non-rotting—and are practically indestructible.

Dust, dirt, pollen, detritus and industrial wastes in the air stream effectively removed with minimum back pressure. No adhesives required.

Made in every size required for industry. In use in a wide range of factory applications, for chemical, textile, and metal-working installations where precision is a factor.

Quotations supplied on receipt of c.f.m. per unit and dimensions of master holding frames. A few choice territories open for qualified representatives.

H. J. SOMERS, INC., 6067 WABASH AVE. DETROIT, MICH.

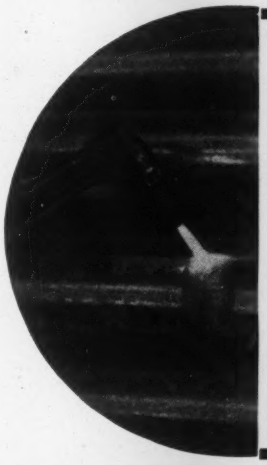
Get Ahead WITH **CHAMPION UNIT HEATERS**

Dependable operation, strong construction and an attractive appearance give you a decided edge in your sales efforts. Write us today for further information.

Send Today for Literature

CHAMPION UNIT HEATER COMPANY

Dept. B 4639-41 Washington Blvd. Chicago, Ill.



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Caused by

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FORMING
BENDING
FABRICATING
RIVETING
THREADING
ABRASION
ASSEMBLING

CAN BE EASILY AND QUICKLY RE-SURFACED EQUAL TO HOT-DIP GALVANIZING WITH

AMCO GALVANIZING POWDER

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AMERICAN SOLDER & FLUX CO.

2150E NORRIS STREET • PHILADELPHIA, PA.

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Install **AIR-MAZE** *Forestall* **COMPLAINTS**

Forestall complaints by installing AIR-MAZE Cleanable Permanent Air Filters *right at the start.* They soon pay for themselves *because they need no replacements*—only an occasional cleaning costing only a few cents. *Write for Catalog GPC-740.*

AIR-MAZE CORPORATION

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AIR-MAZE

DEPENDABLE AIR FILTERS FOR EVERY APPLICATION

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HEAT ENGINEERING
FLUID FLOW
HEAT TRANSFER

Boissevain and Shapiro
77 Massachusetts Ave., Cambridge, Mass.

FOR SALE

For Sale—44 used Frigidaire direct expansion room air conditioning units ¾ and 1 ton capacity complete with expansion valves and thermostats. Good condition—as is $50.00 each. Address Harris and Beeman, Inc., 509 East Third Street, Fort Worth, Texas.

SITUATIONS WANTED

EXPERIENCED ENGINEER, licensed, 20 year practice in piping, in design, installation and supervision of steam heating and power plants also in low and high pressure hot water heating seeks responsible position with consulting, contractor or industrial firm. Now employed, desires change. Address Key No. 349-A, Heating, Piping and Air Conditioning, 6 N. Michigan Ave., Chicago, Ill.

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SEE ESSENTIAL MODERN AIDS TO NATIONAL DEFENSE

THROUGH HEATING, VENTILATING, AIR CONDITIONING

"Because heating, ventilating and air conditioning are essential industries, they enter into every industrial and public building program. For the army camp or home to maintain comfort, efficiency and the health of the occupants, heating, ventilating and air conditioning must play an important part. *For this reason, the exhibits of manufacturers at the 7th International Heating and Ventilating Exposition* take on increasing importance."

Walter L. Fleisher,
Pres. A.S.H.V.E.

Your future depends on how well you can help to plan and equip heating, ventilating and air conditioning installations for defense plants and housing now; and on how well you can meet post-war requirements in your field.

The past two years have been marked by changes in needs, in equipment, appliances, materials and methods. Keep up with the ever-changing picture. See for yourself what's new and good. A few days spent at this biennial exposition will bring you first-hand acquaintance with what leading manufacturers are offering.

Engineering specialists in attendance at exhibits will welcome discussion, consultation and interrogation. They will provide every opportunity for demonstration and comparison. What you can see, hear, and learn here will help you for years to come. Don't pass up this opportunity. Admission is by registration. Be sure to come.

THE AIR CONDITIONING EXPOSITION

SEVENTH
INTERNATIONAL HEATING & VENTILATING EXPOSITION
COMMERCIAL MUSEUM
PHILADELPHIA·PA·
January 26-30-1942

Coincident with the dates of the Exposition, the American Society of Heating and Ventilating Engineers will convene its 48th Annual Meeting. The National Warm Air Heating and Air Conditioning Association and other organizations will meet during the same week.

7th INTERNATIONAL HEATING & VENTILATING EXPOSITION

The Air Conditioning Exposition

COMMERCIAL MUSEUM • PHILADELPHIA • JANUARY 26-30, 1942

Under the Auspices of American Society of Heating and Ventilating Engineers

MANAGED BY INTERNATIONAL EXPOSITION COMPANY

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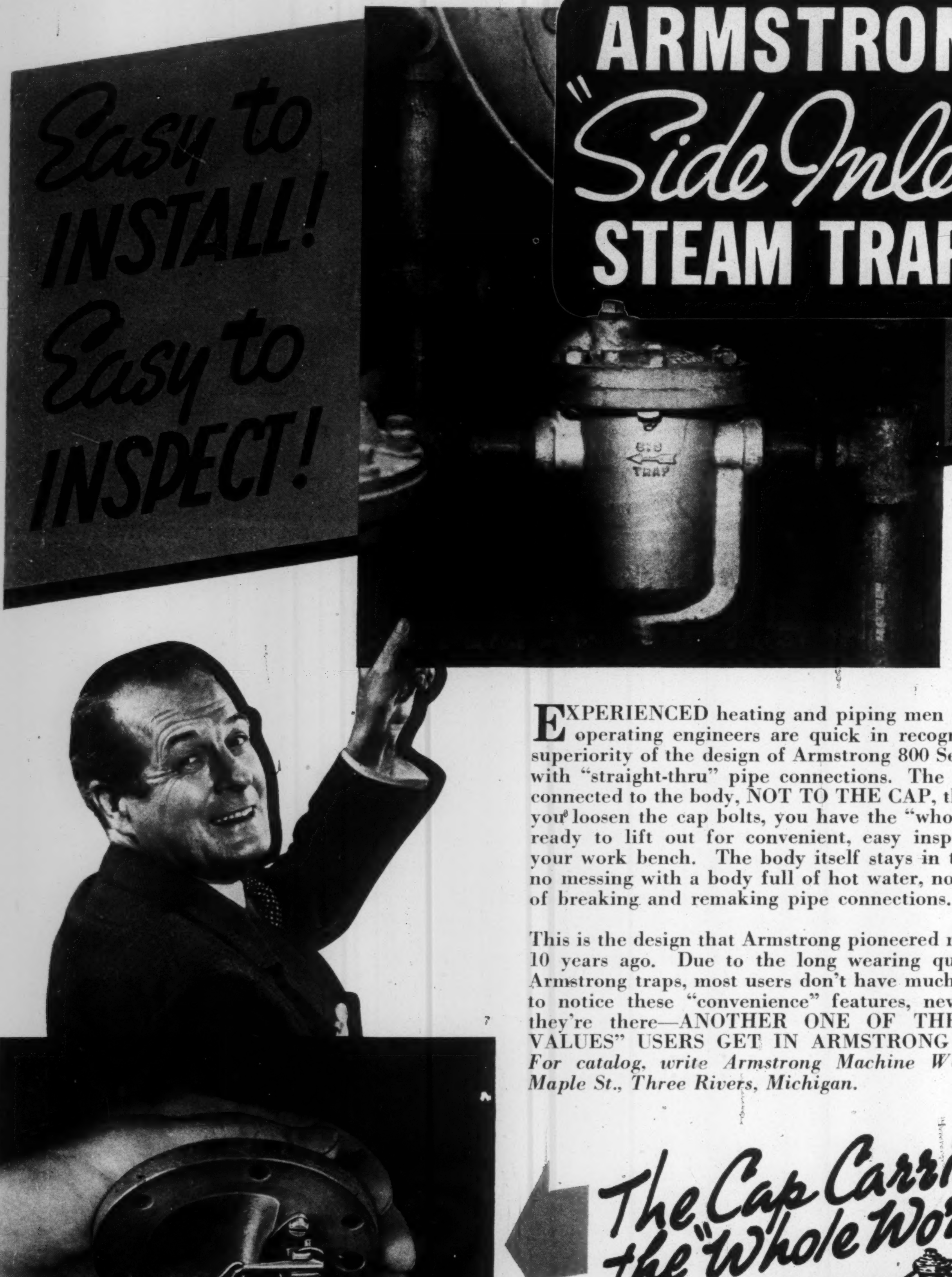
ARMSTRONG "Side Inlet" STEAM TRAPS


Easy to INSTALL!
Easy to INSPECT!
818
TRAP

EXPERIENCED heating and piping men and plant operating engineers are quick in recognizing the superiority of the design of Armstrong 800 Series traps with "straight-thru" pipe connections. The pipes are connected to the body, NOT TO THE CAP, thus, when you loosen the cap bolts, you have the "whole works" ready to lift out for convenient, easy inspection on your work bench. The body itself stays in the line—no messing with a body full of hot water, no nuisance of breaking and remaking pipe connections.

This is the design that Armstrong pioneered more than 10 years ago. Due to the long wearing qualities of Armstrong traps, most users don't have much occasion to notice these "convenience" features, nevertheless, they're there—ANOTHER ONE OF THE "PLUS VALUES" USERS GET IN ARMSTRONG TRAPS! *For catalog, write Armstrong Machine Works, 874 Maple St., Three Rivers, Michigan.*

The Cap Carries the "Whole Works"

ARMSTRONG
"INVERTED BUCKET"
STEAM TRAP

ARMSTRONG MACHINE WORKS

CLARAGE FANS

Chosen for

NEW WAR DEPARTMENT BUILDING

WASHINGTON, D. C.

Designed by Division of Architecture and Engineering of the Public Buildings Administration, Washington.

General Contractor: John McShain, Inc., Philadelphia and Washington, D. C.

Air conditioning and heating contractor: Carlson Bros. of Michigan, Inc., Detroit.

One of the 62 Clarage Fan installations in the New War Department Building, 21st St. and Virginia Ave., N.W., Washington, D. C. — seven stories high — 310,000 sq. ft. of floor space.

Clarage equipment is playing a vital role in National Defense — by supplying conditioned air in important buildings as shown above, and by air conditioning, ventilating and heating industrial plants from coast to coast where planes, tanks, guns and other war requisites are being manufactured.

If you have any type of air handling problem, Clarage can solve that problem satisfactorily and with economy.

Back of Clarage products is more than a quarter-century of engineering and application experience. A Clarage recommendation can be relied upon! See your Sweet's Catalog File, or write us for any desired information.

COMPLETE AIR CONDITIONING
•
COOLING
•
VENTILATION
•
FACTORY HEATING
•
MECHANICAL DRAFT
•
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY–KALAMAZOO, MICH.

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

CURVES AHEAD
Don't
SLOW DOWN

This 45 foot piece of 12¾", .843 carbon moly piping with its complex curves and angles is typical of the vital links in high pressure power systems which Grinnell is building to speed our national defense. Leading manufacturers, utilities and process plants seeking new and expanded power facilities, "Give their plans to Grinnell" for expert interpretation and fabrication of piping.

Grinnell engineers are power specialists, qualified by long experience to interpret even the most complex piping requirements into accurate, heavy-duty super-piping systems. Grinnell plants, strategically located to serve the nation, are equipped with every last facility to prefabricate these systems.

Whether your proposed power extension is simple or complex, Grinnell can simplify your piping problem. Write for Data Book, "Grinnell Prefabricated Piping". Grinnell Company, Inc., Executive Offices, Providence, R. I. Branch offices in principal cities.

PREFABRICATED PIPING BY GRINNELL

WHENEVER **PIPING** IS INVOLVED

HEATING + PIPING AND AIR CONDITIONING

January, 1941

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT
for
INDUSTRY AND LARGE BUILDINGS

HOW TO USE THIS DIRECTORY

If you want to know the names of one or more manufacturers making a certain product, look in Part 1, where that product will appear in its proper place in the listing. If you have the trade name of a product and want to know who manufactures it, look in Part 2, where trade names are alphabetically listed. For the complete name and address of any manufacturer look in Part 3.

● The manufacturers whose names are spotted throughout the listings advertise in this issue. See Index to Advertisers (on last page) for the page on which you will find the advertising of any of these manufacturers.

Heating, Piping and Air Conditioning, Chicago, Ill.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

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ABSORPTION DEHUMIDIFIERS
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ABSORPTION REFRIGERATION MACHINES
See Machines, Refrigeration, Absorption

ACCUMULATORS, REFRIGERATION (FOR AIR CONDITIONING)
●Acme Industries, Inc., Jackson, Mich.
Boester, Carl F., St. Louis, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Frick Co., Waynesboro, Pa.
●McQuay, Inc., Minneapolis, Minn.
Richmond Engineering Co., Inc., Richmond, Va.
Schaub Engineering Co., Fred H., Chicago, Ill.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.

ADJUSTABLE WRENCHES
See Wrenches, Adjustable

ADSORBERS, ODOR
●Airox Co., New York, N. Y. (Chemical for counteracting odors)
Betz Corp., Hammond, Ind.
Carbide and Carbon Chemicals Corp., New York, N. Y.
●Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

ADSORPTION DEHUMIDIFERS
See Dehumidifiers, Absorption and Adsorption

AIR CLEANERS
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AIR COMPRESSORS
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AIR CONDITIONERS
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AIR ELIMINATORS
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AIR VELOCITY METERS
See Meters, Air Velocity, Direct Reading; Anemometers

AIR WASHERS
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ALARMS, SMOKE
Boiler Room Equipment, Inc., New York, N. Y.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Herske & Timmis, Inc., New York, N. Y.

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ANALYZERS, CARBON DIOXIDE, PORTABLE
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Barclay, Inc., Robert, Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Engelhard, Inc., Chas., Newark, N. J.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Hotstream Heater Co., Cleveland, O.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Precision Control Co., San Francisco, Cal.
Preferred Utilities Mfg. Corp., New York, N. Y.
Service to Industry, West Hartford, Conn.
Weaver Mfg. Co., Springfield, Ill.

ANEMOMETERS
American Instrument Co., Silver Spring, Md.
Bristol Co., Waterbury, Conn.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Walker and Eder, Inc., New York, N. Y.
Willson Products, Inc., Reading, Pa. (Thermometer type)

ANGLE VALVES
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ANGLES, BARS, BEAMS, CHANNELS AND TEES (LIGHT WEIGHT SHAPES)
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
American Brass Co., Waterbury, Conn.
Bethlehem Steel Co., Bethlehem, Pa.
Brasco Mfg. Co., Harvey, Ill.
●Byers Co., A. M., Pittsburgh, Pa.
●Carnegie-Illinois Steel Co., Pittsburgh, Pa.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Columbia Steel Co., San Francisco, Cal.
Inland Steel Co., Chicago, Ill.
International Steel Co., Evansville, Ind.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
Lukens Steel Co., Coatesville, Pa.
Milcor Steel Co., Milwaukee, Wis.
●Republic Steel Corp., Cleveland, O.
Revere Copper and Brass, Inc., New York, N. Y.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
●Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Truscon Steel Co., Youngstown, O.
Weirton Steel Co., Weirton, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

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ARC WELDING ELECTRODES
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BASES, MOTOR, TENSION ADJUSTING
Alexander Bros., Philadelphia, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Manley Products Corp., York, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.

● Advertisement in this issue. See Index to Advertisers, page 282.

BASES AND PADS, VIBRATION ISOLATING
●Armstrong Cork Co., Lancaster, Pa.
●Buffalo Forge Co., Buffalo, N. Y.
Butterworth, B. T., Jr., New Canaan, Conn.
●Clarage Fan Co., Kalamazoo, Mich.
●Cork Import Corp., New York, N. Y.
Cork Insulation Co., Inc., New York, N. Y.
Crown Cork & Seal Co., Baltimore, Md.
Felters Co., Inc., Boston, Mass.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Col.
Goodrich Co., B. F., Akron, O.
Keldur Corp., New York, N. Y.
Korfund Co., Long Island City, N. Y.
Lord Mfg. Co., Erie, Pa.
Manley Products Corp., York, Pa.
●Mundet Cork Corp., Brooklyn, N. Y.
National Lead Co., New York, N. Y.
United Cork Companies, Lyndhurst, N. J.
●Vibration Eliminator Co., Astoria, N. Y.
●Western Felt Works, Chicago, Ill.

BEARINGS, BALL
Ahlberg Bearing Co., Chicago, Ill.
Bearings Co. of America, Lancaster, Pa.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., Indianapolis, Ind.
Marlin-Rockwell Corp., Jamestown, N. Y.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
Nice Ball Bearing Co., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
●SKF Industries, Inc., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Shafer Bearing Corp., Chicago, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, PILLOW BLOCK
Ahlberg Bearing Co., Chicago, Ill.
●Air Controls, Inc., Cleveland, O.
Caldwell Co., W. E., Louisville, Ky.
Central Die Casting & Mfg. Co., Inc., Chicago, Ill.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Fafnir Bearing Co., New Britain, Conn.
Goldens' Foundry & Machine Co., Columbus, Ga.
Hastings Air Conditioning Co., Hastings, Neb.
Jeffrey Mfg. Co., Columbus, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
●Lau Blower Co., Dayton, O.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
●Randall Graphite Products Corp., Chicago, Ill.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
●SKF Industries, Inc., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Shafer Bearing Corp., Chicago, Ill.
Smith, Inc., Winfield H., Springville, N. Y.
Sprout, Waldron & Co., Muncy, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Triangle Mfg. Co., Oshkosh, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, ROLLER
Dodge Mfg. Corp., Mishawaka, Ind.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Roller Bearing Co. of America, Trenton, N. J.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
●SKF Industries, Inc., Philadelphia, Pa.
Shafer Bearing Corp., Chicago, Ill.
Timken Roller Bearing Co., Canton, O.
Wood's Sons Co., T. B., Chambersburg, Pa.

BEARINGS, SLEEVE
Dodge Mfg. Corp., Mishawaka, Ind.
Federal-Mogul Corp., Detroit, Mich
Johnson Bronze Co., New Castle, Pa.
Medart Co., St. Louis, Mo.
Motex Metal Process Corp., Detroit, Mich.
●Randall Graphite Products Corp., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wood's Sons Co., T. B., Chambersburg, Pa.

BELLOWS, THERMOSTATIC
●Bishop & Babcock Mfg. Co., Cleveland, O.
Bridgeport Thermostat Co., Bridgeport, Conn.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cook Electric Co., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.

BELTING, FLAT, LEATHER
Alexander Bros., Inc., Philadelphia, Pa.
Chicago Belting Co., Chicago, Ill.
Graton & Knight, Worcester, Mass.
Houghton & Co., E. F., Philadelphia, Pa.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Schieren Co., Chas. A., New York, N. Y.
Williams & Son, I. B., Dover, N. H.

BELTING, FLAT, RUBBER
Boston Woven Hose & Rubber Co., Cambridge, Mass.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Garlock Packing Co., Palmyra, N. Y.
●Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Hamilton Rubber Mfg. Co., Trenton, N. J.
Jeffrey Mfg. Co., Columbus, O.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Quaker Rubber Corp., Philadelphia, Pa.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.

BELTS, V
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Firestone Tire & Rubber Co., Akron, O.
Gates Rubber Co., Denver, Colo.
●Gilmer Co., L. H., Philadelphia, Pa.
Goodrich Co., B. F., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Medart Co., St. Louis, Mo.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Thermoid Rubber Co., Trenton, N. J.
United States Rubber Co., New York, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

BENDERS, PIPE
Alten's Foundry & Machine Works, Lancaster, O.
American Pipe Bending Machine Co., Inc., Boston, Mass.
American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
Blackhawk Mfg. Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Greenlee Mfg. Co., Rockford, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
Martin & Sons, H. P., Owensboro, Ky.
Mueller Brass Co., Port Huron, Mich.
National Pipe Bending Co., New Haven, Conn.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Toledo Pipe Threading Machine Co., Toledo, O.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
●Watson-Stillman Co., Roselle, N. J.

BENDERS, TUBING
American Pipe Bending Machine Co., Inc., Boston, Mass.
Armstrong Mfg. Co., Bridgeport, Conn.
Bernz Co., Inc., Otto, Rochester, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Greenlee Mfg. Co., Rockford, Ill.
Hays Mfg. Co., Erie, Pa. (Copper Tube)
Holsclaw Bros., Inc., Evansville, Ind.
Hossfeld Mfg. Co., Winona, Minn.
Imperial Brass Mfg. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Parker Appliance Co., Cleveland, O.
Pedrick Tool & Machine Co., Philadelphia, Pa.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.

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Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Wallace Supplies Mfg. Co., Chicago, Ill.

BENDS, EXPANSION, STEAM PIPE

American Locomotive Co., Alco Products Div., New York, N. Y.
●Crane Co., Chicago, Ill.
Flori Pipe Co., The, St. Louis, Mo.
●Grinnell Co., Inc., Providence, R. I.
Harris & Co., Arthur, Chicago, Ill. (Stainless & non-ferrous)
Harrisburg Steel Corp., Harrisburg, Pa.
Kellogg Co., M. W., The, New York, N. Y. (Corrugated steel)
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Ohio Pipe Bending & Machine Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.

BI-METALS, THERMOSTATIC

Chace Co., W. M., Detroit, Mich.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Co., H. A., The, Newark, N. J.

BLADES, PROPELLER FAN

Aerovent Fan Co., Piqua, O.
●Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., New York, N. Y.
Circulators & Devices Mfg. Corp., New York, N. Y.
Dallas Engineering Co., Inc., Dallas, Tex.
DeBothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
General Aire Co., Philadelphia, Pa.
General Regulator Corp., Chicago, Ill.
●International Engrg., Inc., Dayton, O.
Lohman, Inc., Wm. J., New York, N. Y.
Mankey Products Co., Inc., Memphis, Tenn.
Meier Electric & Machine Co., Indianapolis, Ind.
Myers Electric Co., Inc., Pittsburgh, Pa.
Norwin Co., Freeport, Ill.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
South Bend Air Products Corp., South Bend, Ind.
Sturtevant Co., B, F., Hyde Park, Boston, Mass.
Swift Mfg. Co., Detroit, Mich.
●Torrington Mfg. Co., Torrington, Conn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.

BLAST HEATERS

See Surface, Heating

BLAST HEATING COILS

See Surface, Heating

BLINDS, VENETIAN

Athey Co., Chicago, Ill.
Bostwick-Goodell Co., Norwalk, O. (Shutter awnings)
Chain Tape Venetian Blind Co., Rockford, Ill.
Chicago Venetian Blind Co., Chicago, Ill.
Columbia Mills, Inc., Saginaw, Mich.
Higgin Products, Inc., Newport, Ky.
Hough Shade Corp., Janesville, Wis.
Kane Mfg. Corp., Kane, Pa.
Miller & Connell Co., Chicago, Ill.
Mitchell Moulding Co., Forest Park, Ill.
Patterson Shade Co., Indianapolis, Ind.
Schatz Venetian Blinds, Los Angeles, Cal.
Snead, Herbert S., New York, N. Y.
Standard Products Co., Detroit, Mich.
Swedish Venetian Blind Co., New York, N. Y.
Warren Shade Co., Inc., Minneapolis, Minn.
Western Venetian Blind Co., New York, N. Y.
Yardley Screen & Weather Strip Co., Columbus, O.

BLOWER FANS

See Fans, Centrifugal

BLOWERS, HIGH PRESSURE

For Low Pressure Blower Fans, See Fans, Centrifugal

Allen Billmyre Corp., South Norwalk, Conn.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Beach-Russ Co., New York, N. Y.
Brundage Co., Kalamazoo, Mich.
●Buffalo Forge Co., Buffalo, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Carling Turbine Blower Co., Worcester, Mass.
Champion Blower & Forge Co., Lancaster, Pa.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Eclipse Fuel Engineering Co., Rockford, Ill.
Garden City Fan Co., Chicago, Ill.
Ingersoll-Rand Co., New York, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Muncie Gear Wks., Muncie, Ind.
North American Mfg. Co., Cleveland, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Boston, Mass.
Trimount Rotary Power Co., East Bedham, Mass.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

BLOWERS, SOOT

Bayer Co., St. Louis, Mo.
Diamond Power Specialty Corp., Detroit, Mich.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Marion Machine Foundry & Supply Co., Marion, Ind.
Perfection Grate & Stoker Co., Springfield, Mass
Sturtevant Co., B. F., Boston, Mass.

BLOWER WHEELS

See Wheels, Blower

BLOW-OFF VALVES

See Valves, Blow-Off

BLUE PRINT MACHINES

See Machines, Blue Print and White Print

BOILER CLEANING COMPOUNDS

See Compounds, Boiler Cleaning

BOILER FEED PUMPS

See Pumps, Boiler Feed

BOILER FEEDERS

See Feeders, Water, Heating Boiler

BOILER SEALING COMPOUNDS

See Compounds, Boiler and Radiator Sealing

BOILER AND TANK INSULATION

See Insulation, Boiler and Tank

BOILER TUBES

See Tubes, Boiler

BOILERS, HEATING, CAST IRON, SECTIONAL

2000 Sq Ft Steam Radiation and Over

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bryan Steam Corp., Peru, Ind.
Bryant Heater Co., The, Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Hart & Crouse Corp., Utica, N. Y.
Herbert Boiler Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

BOILERS, HEATING, STEEL, FIRE TUBE

2000 Sq Ft Steam Radiation and Over

Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Atlantic Steel Boiler Co., Philadelphia, Pa.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.

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Cleaver-Brooks Co., Milwaukee, Wis.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Eclipse Fuel Engineering Co., Rockford, Ill.
Erie City Iron Wks., Erie, Pa.
Farrar & Trefts, Buffalo, N. Y.
●Fitzgibbons Boiler Co., Inc., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Frost Mfg. Co., Galesburg, Ill.
Gallaher Boiler Co., St. Louis, Mo.
General Furnaces Corp., New York, N. Y.
Herbert Boiler Co., Chicago, Ill.
Hodge Boiler Wks., East Boston, Mass.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Johnston Bros., Inc., Ferrysburg, Mich.
Keeler Co., Williamsport, Pa.
●Kewanee Boiler Corp., Kewanee, Ill.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Radiator Co., The, Johnstown, Pa.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.
PS Inc., Los Angeles, Cal. (Flash type)
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Smith Twin Tubular Boiler Co., Inc., Philadelphia, Pa.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Wks., Erie, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Vortex Mfg. Co., Portland, Ore.
Waterfilm Boilers, Inc., Jersey City, N. J.
Wickes Boiler Co., Saginaw, Mich.

BOILERS, HEATING, STEEL, WATER TUBE

Atlantic Steel Boiler Co., Philadelphia, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bass Foundry & Machine Co., Ft. Wayne, Ind.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Bryan Steam Corp., Peru, Ind.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., New York, N. Y.
Edge Moor Iron Wks., Inc., New York, N. Y.
Erie City Iron Wks., Erie, Pa.
Foster Wheeler Corp., New York, N. Y.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Inc., Framingham, Mass.
Keeler Co., E., Williamsport, Pa.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Murray Iron Wks. Co., Burlington, Ia.
Oil City Tank & Boiler Co., Oil City, Pa.
Orr & Sembower, Inc., Reading, Pa.
Riley Stoker Corp., Worcester, Mass.
Smith Twin Tubular Boiler Co., Inc., Philadelphia Pa.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Titusville Iron Wks. Co., Titusville, Pa.
Union Iron Works, Erie, Pa.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Wickes Boiler Co., Saginaw, Mich.

BOLTS, EXPANSION

Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mg. Co., Inc., New York, N. Y.
National Lead Co., New York, N. Y.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
Rolyan Corp., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BOLTS AND STUDS, FLANGE

Bethlehem Steel Co., Bethlehem, Pa.
Clark Bros. Bolt Co., Milldale, Conn.
●Crane Co., Chicago, Ill.
Erie Bolt & Nut Co., Erie, Pa.
Haskell Mfg. Co., Wm. H., Pawtucket, R. I.
Lamson & Sessions Co., Cleveland, O.
Maintenance Engineering Corp., Houston, Texas
Rolyan Corp., Chicago, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

BOLTS, TOGGLE AND ANCHOR

Carty & Moore Engineering Co., Detroit, Mich.
Chicago Expansion Bolt Co., Chicago, Ill.
Diamond Expansion Bolt Co., Inc., Garwood, N. J.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
Lamson & Sessions Co., Cleveland, O.
Paine Co., Chicago, Ill.
Rawlplug Co., Inc., The, New York, N. Y.
●Republic Steel Corp., Cleveland, O.
Rolyan Corp., Chicago, Ill.
Star Expansion Bolt Co., New York, N. Y.
U. S. Expansion Bolt Co., York, Pa.

BRAKES, SHEET METAL

Bertsch & Co., Cambridge City, Ind.
Cincinnati Shaper Co., Cincinnati, O.
Dreis & Krump Mfg. Co., Chicago, Ill.
Elker Mfg. Co., Ogallala, Nebr.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Harris, A. R., Hammond, Ind.
Heartley Machine & Tool Co., Toledo, O.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Ohl & Son, George A., Newark, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Verson Allsteel Press Co., Chicago, Ill.
Whitney Metal Tool Co., Rockford, Ill.

BRASS PIPE

See Pipe, Brass and Copper

BRASS TUBING

See Tubing, Brass and Copper

BRASS UNIONS

See Unions, Brass

BRASS VALVES

See Valves, Gate; and Valves, Globe

BRAZING TORCHES

See Torches, Brazing

BRONZE VALVES

See Valves, Gate; and Valves, Globe

BUILDING INSULATION

See Insulation, Building

BURNERS, GAS, COMMERCIAL AND INDUSTRIAL

Barber Gas Burner Co., Cleveland, O.
Beck Engineering Combustion Kompany, St. Louis, Mo.
Bryant Heater Co., The, Cleveland, O.
Burdett Mfg. Co., Chicago, Ill.
Campbell Heating Co., E. K., Kansas City, Mo.
Continental Stove Corp., Ironton, O.
Coppus Engineering Corp., Worcester, Mass.
Eclipse Fuel Engrg. Co., Rockford, Ill.
Engineer Co., New York, N. Y.
Enterprise Oil Burner Co., San Francisco, Cal.
Hugo Mfg. Co., West Duluth, Minn.
Jamieson Mfg. Co., Dallas, Tex.
Lammert & Mann Co., Chicago, Ill.
Martin, J. O. & C. U., San Francisco, Cal.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
National Machine Wks., Chicago, Ill.
North American Mfg. Co., Cleveland, O.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Peabody Engrg. Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Reznor Mfg. Co., Mercer, Pa.
Roberts-Gordon Appliance Corp., Buffalo, N. Y.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Sonner Burner Co., Winfield, Kans.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
●Surface Combustion Corp., Toledo, O.
●Webster Engineering Co., Tulsa, Okla.
Williams, Inc., F. C., Dearborn, Mich.
●Zink Co., John, Tulsa, Okla.

BURNERS, GAS AND OIL COMBINED, COMMERCIAL AND INDUSTRIAL

Babcock & Wilcox Co., New York, N. Y.
Engineer Co., New York, N. Y.
Enterprise Oil Burner Co., San Francisco, Cal.
Johnson Co., S. T., Oakland, Cal.
Mettler Co., Lee B., Los Angeles, Cal.
National Airoil Burner Co., Inc., Philadelphia, Pa.
Peabody Engineering Corp., New York, N. Y.
R-S Products Corp., Philadelphia, Pa.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
●Webster Engineering Co., Tulsa, Okla.

BURNERS, OIL, COMMERCIAL AND INDUSTRIAL

Ace Engineering Co., Chicago, Ill.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bennett Co., Omaha, Nebr.
Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Caloroil Burner Corp., Hartford, Conn.
Century Engrg. Corp., Cedar Rapids, Ia.
Chalmers Oil Burner Co., Minneapolis, Minn.
Chisholm Co., Allen E., Portland, Ore.
Cleaver-Brooks Co., Milwaukee, Wis.
Combustion Engineering Co., Inc., New York, N. Y.
Connery Construction Co., Philadelphia, Pa.

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Delco Appliance Co., Rochester, N. Y.
Electrol, Inc., Clifton, N. J.
Engineering Co., New York, N. Y.
Enterprise Oil Burner Co., San Francisco, Cal.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hardinge Mfg. & Oil Burner Co., Chicago, Ill.
Harvey-Whipple, Inc., Springfield, Mass.
Holtum Mfg. Co., Freeport, Ill.
Johnson Co., S. T., Oakland, Cal.
Johnson Mfg. Co., Waterloo, Ia.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lammert & Mann Co., Chicago, Ill.
Littleford Bros., Cincinnati, O.
Mettler Co., Lee B., Los Angeles, Cal.
Micro-Westco, Inc., Bettendorf, Ia.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Monarch Mfg. Works., Inc., Philadelphia, Pa.
National Airoil Burner Co., Inc., Philadelpia, Pa.
North American Mfg. Co., Cleveland, O.
Nu-Way Corp., Rock Island, Ill.
Peabody Engrg. Corp., New York, N. Y.
Petroleum Heat & Power Co., Stamford, Conn.
R-S Products Corp., Philadelphia, Pa.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Riley Stoker Corp., Worcester, Mass.
Rotary Mfg. Co., Los Angeles, Cal.
Schutte & Koerting Co., Philadelphia, Pa.
Simplex Oil Heating Corp., New York, N. Y.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Todd Combustion Equipment, Inc., Brooklyn, N. Y.
Vortex Mfg. Co., Portland, Ore.
Wayne Oil Burner Corp., Fort Wayne, Ind.
●Webster Engineering Co., Tulsa, Okla.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.
●Zink Co., John, Tulsa, Okla.

CARBON DIOXIDE ANALYZERS

See Analyzers, Carbon Dioxide, Portable

CARBON DIOXIDE INDICATORS

See Indicators, Carbon Dioxide, Boiler Room

CARBON PIPE, TUBING, FITTINGS AND VALVES

See Pipe, Tubing, Fittings and Valves, Carbon

CAST IRON PIPE

See Pipe, Cast Iron

CEMENT AND COMPOUNDS, PIPE JOINT

Acme Refining Co., The, Cleveland, O.
Acorn Refining Co., Cleveland, O.
Akron Metallic Gasket Co., Akron, O.
Atlas Chemical Co., Marietta, O.
Baer Bros., New York, N. Y.
Barber Asphalt Corp., Barber, N. J.
Blue Seal Chemical Co., Roselle Park, N. J.
Burnley Battery & Mfg. Co., North East, Pa.
Cabot, Inc., Samuel, Boston, Mass.
Calbar Paint & Varnish Co., Philadelphia, Pa.
Carbide and Carbon Chemicals Corp., New York, N. Y.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Continental Products Co., Euclid, O.
Cooper Sanitary Co., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Croll & Son, Jesse G., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Desolvo Co., The, Pittsburgh, Pa.
Detroit Graphite Co., Detroit, Mich.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hercules Chemical Co., Inc., New York, N. Y.
Hetzel Roofing Products Co., Newark, N. J.
Hilo Varnish Corp., Brooklyn, N. Y.
Horn Co., A. C., Long Island City, N. Y.
Key Co., East St. Louis, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Mackson's Co., New York, N. Y.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
Montgomery Bros., San Francisco, Cal.
National Engineering Products, Inc., Washington, D. C.
Preferred Utilities Mfg. Corp., New York, N. Y.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Pyrolite Products Co., Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Rockwood Sprinkler Co., Worcester, Mass.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., F. E., Long Island City, N. Y.
Smooth-On Mfg. Co., Jersey City, N. J.
Star Products Co., New York, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.
Thompson & Co., Pittsburgh, Pa.
U. S. Stonewear Co., New York, N. Y.
Wilhelm Co., A., Reading, Pa.
X Laboratories, Inc., New York, N. Y.
X-Pando Corp., Long Island City, N. Y.

CEMENT, INSULATING

Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Co., The, New York, N. Y.
●Carey Co., Philip, Lockland, Cincinnati, O.
Carney Rockwool Co., Mankato, Minn.
Chicago Fire Brick Co., Chicago, Ill.
Clinton Metallic Paint Co., Clinton, N. Y.
Colebrook & Sons, Inc., W. H., Syracuse, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
General Insulating & Mfg. Co., St. Louis, Mo.
●Grant Wilson, Inc., Chicago, Ill.
Hetzell Roofing Products Co., Newark, N. J.
Industrial Research, Lansdowne, Pa.
International Vermiculite Co., Springfield, Ill.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill. (Asbestos, mineral wool)
McLeod & Henry Co., Troy, N. Y.
Munn and Steele, Inc., Newark, N. J.
National Engineering Products Inc., Washington, D. C.
Norristown Magnesia & Asbestos Co., Norristown, Pa.
●Owens-Corning Fiberglas Corp., Toledo, O.
Pecora Paint Co., Philadelphia, Pa. (Asbestos furnace cement)
Pyrolite Products Co., Cleveland, O.
Ramtite Co., The, Chicago, Ill.
Refractory & Insulation Corp., New York, N. Y.
Ruberoid Co., New York, N. Y.
Rutland Fire Clay Co., Rutland, Vt.
Sall Mountain Co., Chicago, Ill.
Sauereisen Cements Co., Sharpsburg, Pa.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler, Inc., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Fuel Engineering Co., Detroit, Mich.
Standard Lime & Stone Co., Baltimore, Md.
Tennessee Products Corp., Nashville, Tenn.
Therminsul Corp., Kalamazoo, Mich.
Thompson & Co., Pittsburgh, Pa.
United States Gypsum Co., Chicago, Ill.
United States Mineral Wool Co., Chicago, Ill.
Universal Zonolite Insulation Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wilson, Inc., Grant, Chicago, Ill.

CENTRIFUGAL PUMPS

See Pumps, Centrifugal

CHAIN DRIVES

See Drives, Chain

CHANGERS, SPEED, HYDRAULIC COUPLING

American Blower Corp., Detroit, Mich.
Mercury Clutch Corp., Massillon, O.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CHANGERS, SPEED, MECHANICAL

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Briggs & Stratton Co., Milwaukee, Wis.
Browning Mfg. Co., Inc., Maysville, Ky.
Columbia Vari-Speed Co., Wheaton, Ill.
Dodge Mfg. Corp., Mishawaka, Ind.
Jeffrey Mfg. Co., Columbus, O.
Lewellen Mfg. Co., Columbus, Ind.
Link-Belt Co., Philadelphia, Pa.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Reeves Pulley Co., Columbus, Ind.
Speedmaster Co., The, Des Plaines, Ill.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.

CHECK VALVES

See Valves, Check

CHILLERS, WATER, FOR AIR CONDITIONING AND REFRIGERATION

●Acme Industries, Inc., Jackson, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Drayer & Hanson, Inc., Los Angeles, Cal.
Filtrine Mfg. Co., Brooklyn, N. Y.
●Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Griscom-Russell Co., The, New York, N. Y.
Howe Ice Machine Co., Chicago, Ill.
●McQuay, Inc., Minneapolis, Minn.
Mojonnier Bros. Co., Chicago, Ill.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Taco Heaters, Inc., New York, N. Y.
●Vilter Mfg. Co., Milwaukee, Wis.

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Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
●Whitlock Mfg. Co., Hartford, Conn.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

CIRCULATORS FOR HOT WATER HEATING SYSTEMS

American-Marsh Pumps, Inc., Battle Creek, Mich.
●Bell & Gossett Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Frederick Iron & Steel Co., Frederick, Md.
General Blower Co., Inc., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Hotstream Heater Co., Cleveland, O.
Kehm Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mojonnier Brothers Co., Chicago, Ill.
Penberthy Injector Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
Weil Pump Co., Chicago, Ill.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Yeomans Bros. Co., Chicago, Ill.

CLAMPS, BEAM, PIPE HANGING

Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Limbert & Co., Geo. B., Chicago, Ill.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rockwood Sprinkler Co., Worcester, Mass.
Walworth Co., New York, N. Y.

CLAMPS, PIPE REPAIR

Alten's Foundry & Machine Works, Lancaster, O.
Chelsea Metal Stamping Co., New York, N. Y.
Dresser Mfg. Co., Bradford, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
Jarecki Mfg. Co., Erie, Pa.
Skinner Co., M. B., South Bend, Ind.

CLAMPS, PIPE, WELDING

●Jewel Mfg. Co., St. Paul, Minn.
Smooth-On Mfg. Co., Jersey City, N. J.

CLEANERS, AIR, ELECTRICAL

●American Air Filter Co., Inc., Louisville, Ky.
Pangborn Corp., Hagerstown, Md.
●Westinghouse Electric & Mfg. Co., Cleveland, O.

CLEANERS, TUBE

Albright Equipment Co., Pittsburgh, Pa.
Armstrong Mfg. Co., Bridgeport, Conn.
Elliott Co., Jeannette, Pa.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mall Tool Co., Chicago, Ill.
Perfection Grate & Stoker Co., Springfield, Mass.
Pierce Co., Wm. B., The, Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Spencer Turbine Co., Hartford, Conn.

CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

COILS

See Surface, Cooling; Surface, Heating

COILS, PIPE

●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Frick Co., Waynesboro, Pa.
●Marlo Coil Co., St. Louis, Mo.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Vogt Machine Co., Henry, Louisville, Ky.

COLLECTORS, DUST

●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., South Norwalk, Conn.
●American Air Filter Co., Louisville, Ky.
American Blower Corp., Detroit, Mich.
American Foundry Equipment Co., Mishawaka, Ind.
Bayley Blower Co., Milwaukee, Wis.
Blower Application Co., Milwaukee, Wis.
Bubar, Hudson H., New York, N. Y.
●Buffalo Forge Co., Buffalo, N. Y.
Clark Dust Control Co., Chicago, Ill.
Day Co., The, Minneapolis, Minn.
Dracco Corp., Cleveland, O.
Falstrom Co., Passaic, N. J.
Faraday Engineering Co., Boston, Mass.
Garden City Fan Co., Chicago, Ill.
Goethel Co., Alfred C., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Industrial Sheet Metal Wks., Inc., Detroit, Mich.
Jacobs Co., B. & J., Cincinnati, O.
Kirk & Blum Mfg. Co., Cincinnati, O.
Knickerbocker Co., Jackson, Mich.
Martin Metal Mfg. Co., Wichita, Kan.
New York Blower Co., Chicago, Ill.
Northern Blower Co., Cleveland, O.
Pangborn Corp., Hagerstown, Md.
Prat-Daniel Corp., Port Chester, N. Y.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Research Corp., New York, N. Y.
Ruemelin Mfg. Co., Milwaukee, Wis.
Schneible Co., Claude B., Chicago, Ill.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis. Blow Pipe & Heater Co., St. Louis, Mo.
Sly Mfg. Co., W. W., Cleveland, O.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Spencer Turbine Co., Hartford, Conn.
Steamaire Co., Cincinnati, O.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Sturtevant Mill Co., Boston, Mass.
Western Blower Co., Seattle, Wash.
Western Precipitation Corp., Los Angeles, Cal.
Young & Bertke Co., Cincinnati, O.

COLLECTORS, WELDING FUME

Faraday Engineering Co., Boston, Mass.
Lincoln Electric Co., Cleveland, O.
Ruemelin Mfg. Co., Milwaukee, Wis.

COMBUSTION CONTROL

See Regulators, Draft, Combustion

COMBUSTION CONTROL SYSTEMS

See Systems, Combustion Control

COMBUSTION RECORDERS

See Recorders, Carbon Dioxide

COMPOUNDS, BOILER CLEANING

Acme Refining Co., The, Cleveland, O.
American Teksag Products, Inc., Mount Vernon, N. Y.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Brown-Ford Corp., Newton, Mass.
Chicago Specialty Mfg. Co., Chicago, Ill.
Continental Products Co., Euclid, O.
Dearborn Chemical Co., Chicago, Ill.
Dissolene Corp., Hempstead, N. Y.
Ferro-Nil Corp., New York, N. Y.
Grief, Edward C., Bogota, N. J.
Haering & Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
North American Fibre Products Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., The, New York, N. Y.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, BOILER AND RADIATOR SEALING

Atlas Chemical Co., Marietta, O.
Blue Seal Chemical Co., Roselle Park, N. J.
Chicago Specialty Mfg. Co., Chicago, Ill.
Cooper Sanitary Co., Philadelphia, Pa.
Desolvo Co., The, Pittsburgh, Pa.
●Dole Valve Co., The, Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
Krehbiel Co., J. H., Chicago, Ill.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Engineering Products, Inc., Washington, D. C.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Star Products Co., New York, N. Y.
Vinco Co., Inc., The, New York, N. Y.
X Laboratories, Inc., New York, N. Y.

COMPOUNDS, CAULKING

Accurate Metal Weather Strip Co., New York, N. Y.
Acme Refining Co., The, Cleveland, O.
All Metal Weatherstrip Co., Chicago, Ill.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Barlock Co., Inc., Long Island City, N. Y.
American Metal Weather Strip Co., Grand Rapids, Mich.
Armstrong Co., The, Detroit, Mich.
Asphalt Products Co., Syracuse, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 282.

Barber Asphalt Corp., Barber, N. J.
Barland Weatherstrip Material Co., Cleveland, O.
Calbar Paint & Varnish Co., Philadelphia, Pa.
●Carey Co., Philip, Cincinnati, O.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Clinton Metallic Paint Co., Clinton, N. Y.
Continental Products Co., Euclid, O.
Diamond Metal Weather Strip Co., Columbus, O.
Flintkote Co., New York, N. Y.
Ford Roofing Products Co., Chicago, Ill.
Hetzel Roofing Products Co., Newark, N. J.
Horn Co., A. C., Long Island City, N. Y.
Iowa Paint Mfg. Co., Des Moines, Ia.
Johns-Manville, New York, N. Y.
Klee Co., Geo. B., Cincinnati, O.
Krehbiel Co., J. H., Chicago, Ill.
Lastik Products Co., Inc., Pittsburgh, Pa.
Lehon Co., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
Metropolitan Refining Co., Inc., Long Island City, N. Y.
National Mfg. Corp., Tonawanda, N. Y.
Nebel Mfg. Co., Cleveland, O.
North American Fibre Products Co., The, Cleveland, O.
Ohmlac Paint & Refining Co., Chicago, Ill.
Pecora Paint Co., Philadelphia, Pa.
Plastic Products Co., Detroit, Mich.
Presstite Engineering Co., St. Louis, Mo.
Pyrolite Products Co., Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.
Reilly Tar & Chemical Corp., Indianapolis, Ind.
Robertson Co., H. H., Pittsburgh Pa.
Smooth-On Mfg. Co., Jersey City, N. J.
Thompson & Co., Pittsburgh, Pa.
Wilhelm Co., A., Reading, Pa.
X-Pando Corp., Long Island City, N. Y.
Yardley Screen & Weather Strip Corp., Columbus, O.

COMPOUNDS, CLEANING, PIPE COIL AND CONDENSER

Aquatic Chemical Laboratories, Inc., New York, N. Y.
Blue Seal Chemical Co., Roselle Park, N. J.
Cannon Chemical Co., Everett, Mass.
Dearborn Chemical Co., Chicago, Ill.
Forslund Pump & Machinery Co., Kansas City, Mo.
Fuelmiser Co., Inc., Minneapolis, Minn.
Haering Co., Inc., D. W., Chicago, Ill.
Hercules Chemical Co., Inc., New York, N. Y.
North American Fibre Products Co., The, Cleveland, O.
Radiator Specialty Co., Charlotte, N. C.

COMPRESSOR BASES

See Bases and Pads, Vibration Isolating

COMPRESSORS, AIR

Allen Billmyre Corp., South Norwalk, Conn.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Beach-Russ Co., New York, N. Y.
●Binks Mfg. Co., Chicago, Ill.
Brunner Mfg. Co., Utica, N. Y.
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Dayton Air Compressor Co., Dayton, O.
DeVilbiss Co., The, Toledo, O.
Fuller Co., Catasauqua, Pa.
Gardner-Denver Co., Quincy, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hobart Bros., Troy, O.
Ingersoll-Rand, New York, N. Y.
Janette Mfg. Co., Chicago, Ill.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Plummer Spray Equipment Co., Napoleon, O.
Schramm, Inc., West Chester, Pa.
Spencer Turbine Co., Hartford, Conn.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Trimount Rotary Power Co., East Dedham, Mass.
Union Steam Pump Co., Battle Creek, Mich.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

COMPRESSORS, REFRIGERATING, CENTRIFUGAL

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y. (Carrene)
DeLaval Steam Turbine Co., Trenton, N. J. (Water vapor).
Ingersoll-Rand, New York, N. Y. (Water vapor).
●Trane Co., LaCrosse, Wis.
York Ice Machinery Corp., York, Pa.

COMPRESSORS, REFRIGERATING, RECIPROCATING

Airtemp, Div. of Chrysler Corp., Dayton, O. (Radial).
●Baker Ice Machine Co., Inc., Omaha, Nebr. ("Freon," Methyl chloride, Ammonia).
Brunner Mfg. Co., Utica, N. Y. (Methyl chloride, "Freon," sulphur dioxide).
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y. ("Freon")
Copeland Refrigeration Corp., Sidney, O.
Corozone Air Conditioning Corp., Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
De La Vergne Engine Co., Philadelphia, Pa. (Ammonia, "Freon").
Fairbanks, Morse & Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa. (Ammonia, carbon dioxide, methyl chloride, "Freon").
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Machinery Co., Spokane, Wash.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hardy Mfg. Co. Inc., Dayton, O. (Sulphur dioxide, methyl chloride, "Freon").
Howe Ice Machine Co., Chicago, Ill. ("Freon," ammonia, methyl chloride).
Ingersoll-Rand, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Merchant & Evans Co., Philadelphia, Pa. ("Freon," methyl chloride, sulphur dioxide).
Mills Novelty Co., Chicago, Ill.
Modern Equipment Corp., Defiance, O.
Nash Refrigeration Co., Inc., Newark, N. J.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Phoenix Ice Machine Co., Cleveland, O.
Reliance Refrigerating Machine Co., Chicago, Ill. ("Freon," methyl chloride, ammonia).
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind. ("Freon," methyl chloride).
Starr Piano Co., Richmond, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Tecumseh Products Co., Tecumseh, Mich.
●Trane Co., La Crosse, Wis.
Triumph Ice Machine Co., Cincinnati, O. (Ammonia).
Uniflow Mfg. Co., Erie, Pa. (Sulphur dioxide, methyl chloride).
Universal Cooler Corp., Marion, O. (Methyl chloride, "Freon").
●Vilter Mfg. Co., Milwaukee, Wis. ("Freon," ammonia).
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill. ("Freon," methyl chloride).
Wittenmeier Machinery Co., Chicago, Ill. (Carbon dioxide).
XL Refrigerating Co., Chicago, Ill. (Ammonia, methyl chloride).
York Ice Machinery Corp., York, Pa. (Carbon dioxide, ammonia, "Freon").

COMPRESSORS, REFRIGERATING, STEAM JET

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Foster Wheeler Corp., New York, N. Y.
Ingersoll-Rand, New York, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

COMPRESSORS, STEAM BOOSTER

Foster Wheeler Corp., New York, N. Y.
Ingersoll-Rand, New York, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

CONDENSATION METERS

See Meters, Condensation

CONDENSATION PUMPS

See Pumps, Condensation

CONDENSERS, REFRIGERATING, EVAPORATIVE

●Acme Industries, Inc., Jackson, Mich.
American Cooling Tower Co., Kansas City, Mo.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
Clendenin Bros., Inc., Baltimore, Md.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Faraday Engineering Co., Boston, Mass.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G & O Mfg. Co., New Haven, Conn.

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●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Hess Warming & Ventilating Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Long Mfg., Div. Borg-Warner Corp., Detroit, Mich.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Richmond Engrg. Co., Inc., Richmond, Va.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
XL Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

CONDENSERS, REFRIGERATING, SHELL AND TUBE

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y. (Carrene).
De La Vergne Engine Co., Philadelphia, Pa.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Harrison Radiator Div., Lockport, N. Y.
Howe Ice Machine Co., Chicago, Ill.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
Nash Refrigeration Co., Inc., Newark, N. J.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Ohio Pipe Bending & Machine Co., Cleveland, O.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
Richmond Engrg. Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., Evansville, Ind.
Stewart Ice Machine Co., Los Angeles, Cal.
Struthers-Wells-Titusville Co., Titusville, Pa.
Triumph Ice Machine Co., Cincinnati, O. (Ammonia).
Union Steam Pump Co., Battle Creek, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wittenmeier Machinery Co., Chicago, Ill.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

CONDENSING UNITS

See Compressors

CONDUIT, UNDERGROUND PIPING

●American District Steam Co., North Tonawanda, N. Y.
Dockstader, S. E., Washington, D. C.
●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Johns-Manville, New York, N. Y.
Michigan Pipe Co., Bay City, Mich.
●Porter & Co., Inc., H. W., Newark, N. J.
●Ric-wiL Co., Cleveland, O.
Underground Steam Construction Co., Boston, Mass.
Wyckoff & Son Co., A., Elmira, N. Y.

CONNECTIONS, DUCT, FLEXIBLE (ASBESTOS, CANVAS, ETC.)

Canvas Products Co., St. Louis, Mo.
Carpenter & Co., Geo. B., Chicago, Ill.
Felters Co., Inc., Boston, Mass.
●Grant Wilson, Inc., Chicago, Ill.
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos).

CONTROLLERS AND STARTERS, MOTOR

●Allen-Bradley Co., Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elec. Co., Hartford, Conn.
Bender Warrick Corp., Birmingham, Mich.
Clark Controller Co., Cleveland, O.
Cutler-Hammer, Inc., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
Electric Machinery Co., Minneapolis, Minn. (Synchronous motor).
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Reynolds Electric Co., Chicago, Ill.
Square D Co., Milwaukee, Wis.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONTROLS, SPRINKLER SYSTEM

American District Telegraph Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Square D Co., Detroit, Mich.

CONVECTORS

See Radiation, Convection Type

COOLERS, UNIT (FLOOR TYPE)

Not air conditioning units, but floor mounted unit with coil and centrifugal fans without filters, for connection to remote compressor or cold water supply. For air conditioning units see Units, Air Conditioning

●Acme Industries, Inc., Jackson, Mich.
Air Devices Corp., Meriden, Conn.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Ballantyne Co., Omaha, Neb.
●Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●Murray Mfg. Co., D. J., Wausau, Wis.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Richmond Engineering Co., Inc., Richmond, Va.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
●Trane Co., LaCrosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

COOLERS, UNIT (SUSPENDED TYPE)

Not air conditioning units, but suspended unit with coil and propellor fan, without filters, for connection to remote compressor or cold water supply. For air conditioning units, see Units, Air Conditioning

●Acme Industries, Inc., Jackson, Mich.
American Blower Corp., Detroit, Mich.
●Baker Ice Machine Co., Inc., Omaha, Nebr.
Ballantyne Co., Omaha, Neb.
●Beacon-Morris Corp., Boston, Mass. (Custom built)
Berns Specialty Co., Chicago, Ill.
●Buffalo Forge Co., Buffalo, N. Y.
Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Conditionaire Unit Co., Chicago, Ill.
Coolmaster Corp., Chicago, Ill. (Evaporative cooling principle, no dehumidifying)
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.

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●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
Howe Ice Machine Co., Chicago, Ill.
●Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
●Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Merchant & Evans Co., Philadelphia, Pa.
●Murray Mfg. Co., D. J., Wausau, Wis.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Richmond Engrg. Co., Inc., Richmond, Va.
Simmons Co., Gordon H., Milwaukee, Wis.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
Thermal Co., Inc., Milwaukee, Wis.
●Trane Co., LaCrosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Vilter Mfg. Co., Milwaukee, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

COOLING COILS

See Surface, Cooling

COOLING SURFACE

See Surface, Cooling

COOLING TOWERS

See Towers, Cooling

COOLING UNITS

See Units, Air Conditioning; Coolers, Unit

COPPER PIPE

See Pipe, Brass and Copper

COPPER SHEETS

See Sheets, Copper

COPPER TUBE FITTINGS

See Fittings, Copper Tube

COPPER TUBING

See Tubing, Brass and Copper

COUNTERS, DUST

Bausch & Lomb Optical Co., Rochester, N. Y.
Service to Industry, West Hartford, Conn.
Willson Products, Inc., Reading, Pa.

COUPLINGS, FLEXIBLE, POWER TRANSMISSION

Ajax Flexible Coupling Co., Westfield, N. Y.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Flexible Coupling Co., Erie, Pa.
Bartlett Hayward Co., Baltimore, Md.
Blood Brothers, Allegan, Mich. (Universal joints)
Boston Gear Wks., Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Certified Flexible Couplings, Inc., New York, N. Y.
Chain Belt Co., Milwaukee, Wis.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Continental Diamond Fibre Co., Newark, Del.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
De Laval Steam Turbine Co., Trenton, N. J.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Dodge Mfg. Corp., Mishawaka, Ind.
Flexo Supply Co., Inc., St. Louis, Mo.
Frederick Iron & Steel Co., Frederick, Md.
Guardian Utilities Co., Michigan City, Ind.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Kraissl Co., Inc., The, Hackensack, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Link-Belt Co., Chicago, Ill.
Lord Mfg. Co., Erie, Pa.
Lovejoy Flexible Coupling Co., Chicago, Ill.
Medart Co., St. Louis, Mo.
Mercury Clutch Corp., Massillon, O.
Monarch Mfg. Works, Inc., Philadelphia, Pa.
Moran Flexible Steam Joint Co., Louisville, Ky.
Morse Chain Co., Ithaca, N. Y.
Poole Foundry & Machine Co., Baltimore, Md.
Shallcross Co., Philadelphia, Pa.
Smith, Inc., Winfield H., Springville, N. Y.
Waldron Corp., John, New Brunswick, N. J.
Whitney Chain & Mfg. Co., The, Hartford, Conn.
Wood's Sons Co., T. B., Chambersburg, Pa.

COUPLINGS, PIPE

Alabama Pipe Co., Anniston, Ala. (Cast iron).
●Byers Co., A. M., Pittsburgh, Pa.
Champion Machine & Forging Co., Cleveland, O.
Clow & Sons, James B., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Works, Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
H. & B. Sales Co., Ltd., Long Beach, Cal. (Swing joint)
Harrisburg Steel Corp., Harrisburg, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Hatch, George E., New York, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Malleable Iron Fittings Co., Branford, Conn.
Mueller Brass Co., Port Huron, Mich.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y. (Cast iron).
●Republic Steel Corp., Cleveland, O.
Semler Co., Jeannette, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber).
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superior Railway Products Corp., Pittsburgh, Pa.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Victaulic Co. of America, New York, N. Y.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
●Watson-Stillman Co., Roselle, N. J.
Weatherhead Co., Cleveland, O.

CUT-OFFS, LOW WATER, HEATING BOILER

Bender Warrick Corp., Birmingham, Mich.
●General Controls Co., Glendale, Calif.
●Maid-O-Mist, Inc., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

CUTTERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Barnes Tool Co., The, New Haven, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
Crown Die & Tool Co., Chicago, Ill.
Erie Tool Works, Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
International Nutyp Tool Co., Oswego, N. Y.
Jarecki Mfg. Co., Erie, Pa.
National Machine Wks., Chicago, Ill.
Nye Tool & Machine Works, The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Boston, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Wallace Supplies Mfg. Co., Chicago, Ill.
Weatherhead Co., Cleveland, O.

CUTTERS, TUBING

Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Bernz Co., Inc., Otto, Rochester, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Works, The, Chicago, Ill.
Parker Appliance Co., Cleveland, O.
Perfection Refrigeration Parts Co., Harvey, Ill.
Ridge Tool Co., Elyria, O.
Sac Tool Mfg. Co., St. Louis, Mo.
Snap-On Tools Corp., Kenosha, Wis.

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Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Trimont Mfg. Co., Boston, Mass.
Wallace Supplies Mfg. Co., Chicago, Ill.

DAMPER OPERATORS

See Operators, Damper

DAMPER REGULATORS

See Regulators, Damper Sets

DAMPERS, DUCT, REMOTE CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
American Warming & Ventilating Co., Toledo, O.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Powers Regulator Co., Chicago, Ill.
Stuart Co., W. W., Des Moines, Ia.
Shallcross Controls, Inc., Milwaukee, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
●Waterloo Register Co., Waterloo, Ia.
Young Regulator Co., Cleveland. O.

DEAERATORS

●Cochrane Corp., Philadelphia, Pa.
Croll-Reynolds Engrg. Co., Inc., New York, N. Y.
Elliott Co., Jeannette, Pa.
Hoppes Mfg. Co., Springfield, O.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Sims Co., Erie, Pa.
Worthington Pump & Machinery Corp., Harrison, N. J.

DEEP WELL PUMPS

See Pumps, Deep Well

DEHUMIDIFIERS, ABSORPTION AND ADSORPTION

●Air & Refrigeration Corp., New York, N. Y.
American Injector Co., Detroit, Mich.
Aqua-Sorb Co., East Orange, N. J.
Bryant Heater Co., The, Cleveland. O. (Silica gel)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Triethylene Glycol)
●Carrier Corp., Syracuse, N. Y.
●Kaufman, H. J., Detroit, Mich.
Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.
Research Corp., New York, N. Y.
●Surface Combustion Corp., Toledo, O.

DEHUMIDIFYING UNITS

See Units, Air Conditioning; Dehumidifiers, Absorption and Adsorption

DEHYDRANT AND ACID NEUTRALIZER, FOR REFRIGERATING SYSTEMS

Highside Chemicals Co., Newark, N. J.

DESUPERHEATERS, STEAM

Edge Moor Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Northern Equipment Co., Erie, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.

DETECTORS, LEAK, REFRIGERANT

Bernz Co., Inc., Otto, Rochester, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Turner Brass Wks., Sycamore, Ill.

DIAPHRAGM VALVES

See Valves, Diaphragm

DIESEL ENGINES

See Engines, Diesel, for Fan, Pump and Compressor Drives

DIFFUSERS, AIR, HIGH VELOCITY

●Air Devices, Inc., New York, N. Y.
Anemostat Corp. of America, New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Demuth & Sons, Charles, Jamaica, N. Y.
Plandaire Inc., Pittsburgh, 13, Pa.
●Tuttle & Bailey, Inc., New Britain, Conn.
●Waterloo Register Co., Waterloo, Ia.

DOORS AND PANELS, ACCESS

American Foundry & Furnace Co., Bloomington, Ill.
American Sheet Metal Works, New Orleans, La.
●Auer Register Co., Cleveland, O.
●Clarage Fan Co., Kalamazoo, Mich.
Falstrom Co., Passaic, N. J.
Higgin Products, Inc., Newport, Ky.
Kirk & Blum Mfg. Co., Cincinnati, O.
Lawson Co., F. H., Cincinnati, O.
Milcor Steel Co., Milwaukee, Wis.
Rock Island Register Co., Rock Island, Ill.
Truscon Steel Co., Youngstown, O.
●Tuttle & Bailey, Inc., New Britain, Conn.
Way Loctor Access Panel Co., Boston, Mass.

DRAFT GAGES

See Gages, Indicating, Draft

DRAFT RECORDERS

See Recorders, Draft

DRAFT REGULATORS

See Regulators, Draft, Combustion

DRILLS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., New York, N. Y.
Cincinnati Electrical Tool Co., The, Cincinnati, O.
Clark, Jr., Electric Co., Jas., Louisville, Ky.
Independent Pneumatic Tool Co., Chicago, Ill.
Mall Tool Co., Chicago, Ill.
Millers Falls Co., Greenfield, Mass.
Misener Mfg. Co., Inc., Syracuse, N. Y.
Power King Tool Corp., Warsaw, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Skilsaw, Inc., Chicago, Ill.
Snap-On Tools Corp., Kenosha, Wis.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Stanley Electric Tool Div., New Britain, Conn.
U. S. Electrical Tool Co., Cincinnati, O.
Van Dorn Electric Tool Co., Towson, Md.
Wodack Electric Tool Corp., Chicago, Ill.

DRIVES, CHAIN

Boston Gear Works, Inc., North Quincy, Mass.
Caldwell Co., W. E., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Co., Indianapolis, Ind.
Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.
Ramsey Chain Co., Inc., Albany, N. Y.
Whitney Chain & Mfg. Co., The, Hartford, Conn.

DRIVES, FLAT BELT

See also Belting, Leather and Belting, Rubber

American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Caldwell Co., W. E., Louisville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago, Ill.
Continental Rubber Wks., Erie, Pa.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Medart Co., St. Louis, Mo.
●Rhoads & Sons, J. E., Philadelphia, Pa.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springfield, N. Y.
Williams & Son, I. B., Dover, N. H.
Wood's Sons Co., T. B., Chambersburg, Pa.

DRIVES, V BELT

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Boston Gear Wks., Inc., North Quincy, Mass.
Browning Mfg. Co., Inc., Maysville, Ky.
Chicago Belting Co., Chicago, Ill.
Chicago Die Casting Mfg. Co., Chicago. Ill.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Continental Rubber Wks., Erie, Pa.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Gates Rubber Co., Denver, Colo.
Goodrich Co., B. F., Akron, O.
Horton Mfg. Co., Minneapolis, Minn.
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Medart Co., St. Louis, Mo.
Pyott Foundry & Machine Co., Chicago, Ill.
Rockwood Mfg. Co., Indianapolis, Ind.
Smith, Inc., Winfield H., Springville, N. Y.
Wood's Sons Co., T. B., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

DUAL THERMOSTATS

See Thermostats, Two Temperature or Dual

DUCT CONNECTIONS

See Connections, Duct, Flexible

DUCT HEATERS

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DUCT INSULATION

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DUCT THERMOSTATS

See Thermostats, Duct Type

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DUCT TURNING VANES

See Vanes, Duct Turning, Prefabricated

DUCTS AND DUCT FITTINGS, PREFABRICATED

Acer & Whedon, Medina, N. Y.
Acme Tin Plate & Roofing Supply Co., Philadelphia, Pa.
●Carey Co., Philip, Cincinnati, O.
Champion Furnace Pipe Co, Peoria, Ill.
Chandler Co., Cedar Rapids, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Chicago Furnace Supply Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Corbman Bros., Inc., Philadelphia, Pa.
Excelsior Steel Furnace Co., Chicago, Ill.
Henry Furnace & Foundry Co., Cleveland, O.
Howes Co., S. M., Charlestown, Boston, Mass.
Lamneck Products, Inc., Middletown, O.
Meyer & Bro. Co., F., Peoria, Ill.
Milcor Steel Co., Milwaukee, Wis.
Moncrief Furnace Co., Atlanta, Ga.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Season-Aire Corp. of America, Detroit, Mich.
United States Register Co., Battle Creek, Mich.
Williamson Heater Co., Cincinnati. O.

DUST COLLECTORS

See Collectors, Dust

DUST COUNTERS

See Counters, Dust

EJECTORS, SEWAGE

American-Marsh Pumps, Inc., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Works Co., Columbus, O.
Economy Pumps, Inc., Chicago, Ill.
●Nash Engineering Co., South Norwalk, Conn.
Penberthy Injector Co., Detroit, Mich.
Quimby Pump Co., Inc., Newark, N. J.
Schutte & Koerting Co., Philadelphia, Pa.
Taber Pump Co., Inc., Buffalo, N. Y.
Weil Pump Co., Chicago, Ill.
Yeomans Bros. Co., Chicago, Ill.

ELECTRIC DRILLS

See Drills, Electric, Portable

ELECTRIC MOTORS

See Motors, Electric

ELECTRIC SHEARS

See Shears, Electric, Portable

ELECTRIC UNIT HEATERS

See Heaters, Unit, Electric Heating Element

ELECTRIC AIR CLEANERS

See Cleaners, Air, Electrical

ELECTRODES, ARC WELDING

Air Reduction Sales Co., New York, N. Y.
Aluminum Co. of America, Pittsburgh, Pa.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Agile Corp., Cleveland, O.
American Brass Co., Waterbury, Conn.
Arcos Corp., Philadelphia, Pa.
Bastian-Blessing Co., Chicago, Ill.
Chicago Steel & Wire Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros., Troy, O.
Lincoln Electric Co., Cleveland, O.
Marquette Mfg. Co., Minneapolis, Minn.
Maurath, Inc., Cleveland, O.
McKay Co., Pittsburgh, Pa.
Metal & Thermit Corp., New York, N. Y.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
Revere Copper & Brass, Inc., New York, N. Y.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Co., Div. of National Cylinder Gas Co., Chicago, Ill.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wilson Welder & Metals Co., Inc., New York, N. Y.

ELIMINATORS, AIR, FOR HEATING AND PIPING SYSTEMS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Anderson Co., V. D., The, Cleveland, O.
Anderson Products, Inc., Cambridge, Mass.
●Armstrong Machine Works, Three Rivers, Mich.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
●Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
●Trane Co., La Crosse, Wis.
Triplex Mfg. Co., Peru, Ind.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

ENAMELS AND LACQUERS

Baer Bros., New York, N. Y.
Debevoise Co., The, Brooklyn, N. Y.
Dragert Co., Inc., C. H., Brooklyn, N. Y.
du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.
Ferro-Enamel Corp., Cleveland, O.
Ford Roofing Products Co., Chicago, Ill.
Glidden Co., Cleveland, O.
Hague & Co., Inc., Alfred, Brooklyn, N. Y.
Hilo Varnish Corp., Brooklyn, N. Y.
Horn Co., A. C., Long Island City, N. Y.
Inter-Coastal Paint Corp., East St. Louis, Ill.
Krehbiel Co., J. H., Chicago, Ill.
Maas & Waldstein Co., Newark, N. J.
O'Brien Varnish Co., South Bend, Ind.
Roxalin Flexible Lacquer Co., Inc., Elizabeth, N. J.
Thompson & Co., Pittsburgh, Pa.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Wilhelm Co., A., Reading, Pa.
Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.

ENGINES, DIESEL, FOR FAN, PUMP AND COMPRESSOR DRIVES

American Locomotive Co., Auburn, N. Y.
Anderson Engine & Foundry Co., Anderson, Ind.
Buda Co., Harvey, Ill.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
De La Vergne Engine Co., Philadelphia, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
General Motors Corp., Detroit, Mich.
Hill Diesel Engine Co., Lansing, Mich.
Ingersoll-Rand, New York, N. Y.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, GAS, FOR FAN, PUMP AND COMPRESSOR DRIVES

Bardco Corp. of America, Los Angeles, Cal.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Continental Motors Corp., Detroit, Mich.
Fairbanks, Morse & Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
Lycoming Mfg. Co., Williamsport, Pa.
U. S. Motors Corp., Oshkosh, Wis.
Universal Motor Co., Oshkosh, Wis.
Waukesha Motor Co., Waukesha, Wis.
●Worthington Pump & Machinery Corp., Harrison, N. J.

ENGINES, STEAM, FOR FAN, PUMP AND COMPRESSOR DRIVES

Ames Iron Wks., Div. of Pierce, Butler Radiator Corp., Oswego, N. Y.
Elliott Co., Jeannette, Pa.
●Frick Co., Waynesboro, Pa.
Harrisburg Fdry. & Mach. Co., Inc., Harrisburg, Pa.
Morris Machine Wks., Baldwinsville, N. Y.
Murray Iron Wks Co., Burlington, Ia.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Skinner Engine Co., Erie, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Troy Engine & Machine Co., Troy, Pa.
●Vilter Mfg. Co., Milwaukee, Wis.

EVAPORATIVE CONDENSERS

See Condensers, Refrigerating, Evaporative

EXPANSION BENDS

See Bends, Expansion

EXPANSION BOLTS

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EXPANSION JOINTS

See Joints, Pipe, Expansion

EXPANSION VALVES

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EXTRACTORS, PIPE

Greenfield Tap & Die Corp., Greenfield, Mass.
Reps Tool, Inc., Buffalo, N. Y.
Ridge Tool Co., Elyria, O.

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FABRICATED PIPING
See Bends; Headers; Joints; etc.

FAN BASES
See Bases and Pads, Vibration Isolating

FAN BLADES
See Blades, Propeller Fan

FAN HOUSINGS
See Housings, Fan, Centrifugal

FANS, CENTRIFUGAL
Advance Aluminum Castings Corp., Chicago, Ill.
Advance Fan & Blower Co., Detroit, Mich.
●Air Controls, Inc., Cleveland, O.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Billmyre Corp., New York, N. Y.
American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Furnace Co., St. Louis, Mo.
Ames Co., W. R., San Francisco, Cal.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Autovent Fan & Blower Co., Chicago, Ill.
Ballantyne Co., Omaha, Nebr.
Bayley Blower Co., Milwaukee, Wis.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
Brundage Co., Kalamazoo, Mich.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., Des Moines, Ia.
●Carrier Corp., Syracuse, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Columbus Heating & Ventilating Co., Columbus, O.
Coppus Engineering Corp., Worcester, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Duriron Co., Inc., Dayton, O. (Acid resisting).
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Essick Mfg. Co., Los Angeles, Cal.
Furblo Co., Hermansville, Mich.
Garden City Fan Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
Grand Rapids Die & Tool Co., Grand Rapids, Mich.
●Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
Hirschman Co., W. F., Buffalo, N. Y.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Nebr.
Janette Mfg. Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
●Lau Blower Co., Dayton, O.
Lehigh Fan & Blower Co., Allentown, Pa.
Leinweber Fan & Blower Co., Chicago, Ill.
Magirl Foundry & Furnace Works, P. H., Bloomington, Ill.
Montag Stove & Furnace Wks., Portland, Ore.
Morrison Products, Inc., Cleveland, O.
Mountain States Equipment Co., Denver, Colo.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Palmer's Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Phelps Mfg. Co., Little Rock, Ark.
●Reynolds Mfg. Co., The, Grand Rapids, Mich.
Schwitzer-Cummins Co., Indianapolis, Ind.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Smith Heater Co., Peter, Detroit, Mich.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., Bonner Springs, Kans.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●Torrington Mfg. Co., Torrington, Conn.
●Trane Co., LaCrosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.

FANS, PROPELLER
Aerovent Fan Co., Piqua, O.
●Air Controls, Inc., Cleveland, O.
Aire-Foile Fan & Blower Co., Detroit, Mich.
Airmaster Corp., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., New York, N. Y.
Circulators & Devices Mfg. Corp., New York, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Coppus Engineering Corp., Worcester, Mass.
Dallas Engineering Co., Inc., Dallas, Tex.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Emerson Electric Mfg. Co., St. Louis, Mo.
Esko Mfg. Corp., Houston, Tex.
Fresh'nd-Aire Co., Chicago, Ill.
Garden City Fan Co., Chicago, Ill.
Gas City Glass Co., Gas City, Ind.
General Blower Co., Inc., Philadelphia, Pa.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Regulator Corp., Chicago, Ill.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
●Hall Mfg. Co., Cedar Rapids, Ia.
Hartzell Propeller Fan Co., Piqua, O.
Hirschman Co., W. F., Buffalo, N. Y.
Hudson Equipment Corp., Minneapolis, Minn.
Hunter Fan & Ventilating Co., Inc., Memphis, Tenn.
●Ilg Electric Ventilating Co., Chicago, Ill.
●International Engineering, Inc., Dayton, O.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
King Ventilating Co., Owatonna, Minn.
Kisco Co., Inc., St. Louis, Mo.
●Lau Blower Co., Dayton, O.
Lohman, Inc., Wm. J., New York, N. Y.
Marathon Electric Mfg. Corp., Wausau, Wis.
McCord Radiator & Mfg. Co., Detroit, Mich.
Meier Electric & Machine Co., Indianapolis, Ind.
Mountain States Equipment Co., Denver, Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
New York Blower Co., Chicago, Ill.
Peerless Electric Co., Warren, O. (Disc).
Perkins & Son, Inc., B. F., Holyoke, Mass.
Phelps Mfg. Co., Little Rock, Ark.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Reynolds Electric Co., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Snoair, Dallas, Tex.
South Bend Air Products Corp., South Bend, Ind.
Spray Engineering Co., Somerville, Mass.
Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Truflo Fan Co., Harmony, Pa.
●U S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

FEEDERS, WATER, HEATING BOILER
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Cissell Mfg. Co., W. M., Louisville, Ky.
Davis Regulator Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Healy Ruff Co., St. Paul, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
●Maid-O-Mist, Inc., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

FIBER PACKING
See Packing, Fiber

FILTER GAGES
See Gages, Air Filter

FILTERS, AIR, AUTOMATIC
●Air & Refrigeration Corp., New York, N. Y.
●Air-Stream Filter Corp., St. Louis, Mo.

● Advertisement in this issue. See Index to Advertisers, page 282.

●American Air Filter Co., Inc., Louisville, Ky.
Brauer Supply Co., A. G., St. Louis, Mo.
Coppus Engineering Corp., Worcester, Mass.
Dracco Corp., Cleveland, O.
●Staynew Filter Corp., Rochester, N. Y.

FILTERS, AIR, UNIT, CLEANABLE

●Air-Maze Corp., Cleveland, O.
●Air-Stream Filter Corp., St. Louis, Mo.
●American Air Filter Co., Inc., Louisville, Ky.
American Foundry & Furnace Co., Bloomington, Ill.
Amirton Co., Elmsford, N. Y.
Annis Air Filters, Glendale, Cal.
Brauer Supply Co., A. G., St. Louis, Mo.
Chicago Filter Co., Joliet, Ill.
Coppus Engineering Corp., Worcester, Mass.
Davies Air Filter Corp., New York, N. Y.
Hugo Mfg. Co., West Duluth, Minn.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kleenaire Corp., Stevens Point, Wis.
Kraissl Co., Inc., The, Hackensack, N. J.
Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Supreme Air Filter Co., New York, N. Y.
Tuttle Air Filter Co., Inc., Louisville, Ky.
Universal Air Filter Corp., Duluth, Minn.

FILTERS, AIR, UNIT, THROW-AWAY

●American Air Filter Co., Inc., Louisville, Ky.
Amirton Co., Elmsford, N. Y.
Anderson Products, Inc., Cambridge, Mass.
Blocksom & Co., Michigan City, Ind.
Chicago Filter Co., Joliet, Ill.
Davies Air Filter Corp., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Gehri Co., Tacoma, Wash.
Kleenaire Corp., Stevens Point, Wis.
●Owens-Corning Fiberglas Corp., Toledo, O.
Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.
●Research Products Corp., Madison, Wis.
●Staynew Filter Corp., Rochester, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Wilson & Co., Chicago, Ill.

FILTERS, ODOR

See Adsorbers, Odor

FILTERS, PIPE LINE

Adams Co., R. P., Buffalo, N. Y.
●Alco Valve Co., St. Louis, Mo.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
●Cochrane Corp., Philadelphia, Pa.
Cuno Engineering Corp., Meriden, Conn.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
Johnson Corp., Three Rivers, Mich.
Kraissl Co., Inc., The, Hackensack, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
Newark Wire Cloth Co., Newark, N. J.
Permutit Co., New York, N. Y.
Refinite Corp., Omaha, Neb.
Scientific Instrument Co., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Superior Valve & Fittings Co., Pittsburgh, Pa.

FINNED TUBING

See Tubing, Finned

FIRE PUMPS

See Pumps, Fire

FITTINGS, COPPER TUBE, COMPRESSION

American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Crane Co., Chicago, Ill.
●Dole Valve Co., The, Chicago, Ill.
Hays Mfg. Co., Erie, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Revere Copper & Brass, Inc., New York, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Superseal Corp., New York, N. Y.
VibraSeal Corp., Detroit, Mich.

FITTINGS, COPPER TUBE, SOLDER

American Brass Co., Waterbury, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Revere Copper & Brass, Inc., New York, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, LINED

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Hard Rubber Co., New York, N. Y. (Rubber)
Goodrich Co., B. F., Akron, O. (Rubber)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass.
United States Rubber Co., New York, N. Y. (Rubber)

FITTINGS, PIPE, BRASS, SOLDER

●Crane Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRASS, THREADED

Acheson Mfg. Co., Rankin, Pa.
American Manganese Bronze Co., Philadelphia, Pa.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mueller Brass Co., Port Huron, Mich.
New York Brass Fdry., New York, N. Y.
Parker Appliance Co., Cleveland, O.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rockford Brass Works, Rockford, Ill.
Ross Sprinkler Co., Pasadena, Cal.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Union Metal Wks., Inc., Chelsea, Mass.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, BRASS, WELDING

American Brass Co., Waterbury, Conn.
Bonney Forge & Tool Wks., Allentown, Pa.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
●Tube-Turns, Louisville, Ky.
Walworth Co., New York, N. Y. (Brazed)

FITTINGS, PIPE, BRONZE, BRAZED

●Crane Co., Chicago, Ill.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Walworth Co., New York, N. Y.

FITTINGS, PIPE, CAST IRON, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Eastern Foundry Co., Boyertown, Pa.
●Frick Co., Waynesboro, Pa.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.
Lumsden & Van Stone Co., South Boston, Mass.
Lynchburg Foundry Co., Lynchburg, Va.
National Valve & Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Semler Co., Jeannette, Pa.
Somerville Iron Works, Somerville, N. J.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

FITTINGS, PIPE, CAST IRON, THREADED

Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Eastern Foundry Co., Boyertown, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
●Frick Co., Waynesboro, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Kuhns Bros. Co., Dayton, O.

● Advertisement in this issue. See Index to Advertisers, page 282.

- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Ravena Iron Co., Ravena, N. Y.
- Semler Co., Jeannette, Pa.
- Somerville Iron Works, Somerville, N. J.
- Stockham Pipe Fittings Co., Birmingham, Ala.
- Walworth Co., New York, N. Y.
- Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, LEAD

- Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
- Eagle-Picher Lead Co., Cincinnati, O.
- Flemm Lead Co., Inc., Long Island City, N. Y.
- Lead Lined Iron Pipe Co., Wakefield, Mass.
- Lissberger & Son., Inc., Marks, Long Island City, N. Y.
- National Lead Co., New York, N. Y.

FITTINGS, PIPE, MALLEABLE

- ●Crane Co., Chicago, Ill.
- Detroit Brass & Malleable Wks., Detroit, Mich.
- Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
- Dresser Mfg. Co., Bradford, Pa.
- Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
- General Fittings Co., Providence, R. I.
- Grabler Mfg. Co., Cleveland, O.
- ●Grinnell Co., Inc., Providence, R. I.
- Illinois Malleable Iron Co., Chicago, Ill.
- Jarecki Mfg. Co., Erie, Pa.
- Jefferson Union Co., Lexington, Mass.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Malleable Iron Fittings Co., Branford, Conn.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Rhode Island Fittings Co., Hillsgrove, R. I.
- Stockham Pipe Fittings Co., Birmingham, Ala.
- Victaulic Co. of America, New York, N. Y.
- Walworth Co., New York, N. Y.
- Ward Foundries, Inc., J. P., Blossburgh, Pa.

FITTINGS, PIPE, STEEL, FLANGED

- Alloy Steel Products Co., Linden, N. J. (Stainless steel).
- ●American Rolling Mill Co., The, Middletown, O.
- ●Crane Co., Chicago, Ill.
- Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
- National Valve & Mfg. Co., Pittsburgh, Pa.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- Semet-Solvay Engrg. Corp., New York, N. Y.
- Taylor Forge & Pipe Wks., Chicago, Ill.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, FORGED, THREADED

- ●Crane Co., Chicago, Ill.
- ●Grinnell Co., Inc., Providence, R. I.
- Parker Appliance Co., Cleveland, O.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, SOCKET WELD

- Bonney Forge & Tool Works, Allentown, Pa.
- ●Crane Co., Chicago, Ill.
- ●Grinnell Co., Inc., Providence, R. I.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- ●Taylor Forge & Pipe Wks., Chicago, Ill.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, THREADED

- Alloy Steel Products Co., Linden, N. J. (Stainless steel).
- Central Forging Co., Catawissa, Pa.
- Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
- ●Crane Co., Chicago, Ill.
- Devlin Mfg. Co., Thos., Burlington, N. J.
- Harrisburg Steel Corp., Harrisburg, Pa.
- Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
- Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. J.

FITTINGS, PIPE, STEEL, WELDING

- ●American Rolling Mill Co., The, Middletown, O.
- Bonney Forge & Tool Wks., Allentown, Pa.
- Central Forging Co., Catawissa, Pa.
- ●Crane Co., Chicago, Ill.
- ●Grinnell Co., Inc., Providence, R. I.
- Larkin Packer Co., St. Louis, Mo.
- ●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
- National Valve & Mfg. Co., Pittsburgh, Pa.
- Oil Well Supply Co., Oil City, Pa.
- Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
- ●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
- Semet-Solvay Engineering Corp., New York, N. Y.
- ●Taylor Forge & Pipe Wks., Chicago, Ill.
- ●Tube-Turns, Louisville, Ky.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- Wedge Protectors, Inc., Cleveland, O. (Chill rings)

FITTINGS, PIPE, WROUGHT IRON, WELDING

- Bonney Forge & Tool Wks., Allentown, Pa.
- ●Grinnell Co., Inc., Providence, R. I.
- ●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
- National Valve & Mfg. Co., Pittsburgh, Pa.
- Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
- ●Taylor Forge & Pipe Wks., Chicago, Ill.
- ●Tube-Turns, Louisville, Ky.
- Walworth Co., New York, N. Y.

FITTINGS, REFRIGERATION

- American Injector Co., Detroit, Mich.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- ●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
- Chase Brass & Copper Co., Inc., Waterbury, Conn.
- Commonwealth Brass Corp., Detroit, Mich.
- ●Crane Co., Chicago, Ill.
- ●Frick Co., Waynesboro, Pa.
- ●Henry Valve Co., Chicago, Ill.
- Imperial Brass Mfg. Co., Chicago, Ill.
- Kerotest Mfg. Co., Pittsburgh, Pa.
- Mueller Brass Co., Port Huron, Mich.
- Northern Indiana Brass Co., Elkhart, Ind.
- Parker Appliance Co., Cleveland, O.
- Superior Valve and Fittings Co., Pittsburgh, Pa.
- Triumph Ice Machine Co., Cincinnati, O.
- ●Vilter Mfg. Co., Milwaukee, Wis.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- ●Watson-Stillman Co., Roselle, N. J.
- Weatherhead Co., Cleveland, O.
- Wittenmeier Machinery Co., Chicago, Ill.
- X L Refrigerating Co., Inc., Chicago, Ill.
- York Ice Machinery Corp., York, Pa.

FLANGE BOLTS

See Bolts and Studs, Flange

FLANGES, PIPE

- ●American Rolling Mill Co., The, Middletown, O.
- ●Baker Ice Machine Co., Inc., Omaha, Nebr.
- Clow & Sons, James B., Chicago, Ill.
- Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
- ●Crane Co., Chicago, Ill.
- ●Dart Mfg. Co., E. M., Providence, R. I.
- Devlin Mfg Co., Thos., Burlington, N. J.
- Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
- Grabler Mfg. Co., Cleveland, O.
- ●Grinnell Co., Inc., Providence, R. I.
- Harrisburg Steel Corp., Harrisburg, Pa.
- Hasco Valve & Machine Co., Milwaukee, Wis. (Stainless steel only)
- Illinois Malleable Iron Co., Chicago, Ill.
- Jarecki Mfg. Co., Erie, Pa.
- Kennedy Valve Mfg. Co., Elmira, N. Y.
- Kuhns Bros. Co., Dayton, O.
- Limbert & Co., Geo. B, Chicago, Ill.
- Lumsden & Van Stone Co., South Boston, Mass.
- Lynchburg Foundry Co., Lynchburg, Va.
- ●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
- National Valve & Mfg. Co., Pittsburgh, Pa.
- Naylor Pipe Co., Chicago, Ill.
- Pennsylvania Forge Co., Philadelphia, Pa.
- Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
- Pittsburgh Valve & Fittings Corp., Barberton, O.
- Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
- Ravena Iron Co., Ravena, N. Y.
- Rhode Island Fittings Co., Hillsgrove, R. I.
- Semet-Solvay Engineering Corp., New York, N. Y.
- Semler Co., Jeannette, Pa.
- Steel Improvement & Forge Co., Cleveland, O.
- Stockham Pipe Fittings Co., Birmingham, Ala.
- Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
- ●Taylor Forge & Pipe Wks., Chicago, Ill.
- ●Tube-Turns, Louisville, Ky.
- Vogt Machine Co., Henry, Louisville, Ky.
- Walworth Co., New York, N. Y.
- Ward Foundries, Inc., J. P., Blossburgh, Pa.
- Warren Foundry & Pipe Corp., New York, N. Y.

FLEXIBLE COUPLINGS

See Couplings, Flexible

FLEXIBLE DUCT CONNECTIONS

See Connections, Duct, Flexible

FLEXIBLE METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

FLOAT SWITCHES

See Switches, Float

FLOAT VALVES

See Valves, Float

● Advertisement in this issue. See Index to Advertisers, page 282.

FLOATS, STEAM TRAP, ETC.

Clark Controller Co., Cleveland, O.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
Harris & Co., Arthur, Chicago, Ill.
Hercules Float Wks., Springfield, Mass.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Naugatuck Mfg. Co., Union City, Conn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Reichert Float & Mfg. Co., Toledo, O.
Reliance Gauge Column Co., Cleveland, O.
Sterling, Inc., Milwaukee, Wis.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Trane Co., LaCrosse, Wis.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

FLOOR AND CEILING PLATES

See Plates, Floor and Ceiling

FLOW METERS

See Meters, Flow

FLOW SWITCHES

See Switches, Flow

FORGED STEEL VALVES

See Valves, Forged Steel

FURNACES, WARM AIR, FOR INDUSTRIAL AND LARGE BUILDING HEATING

Acme Heating & Ventilating Co., Inc., Chicago, Ill.
●Air Devices, Inc., New York, N. Y.
American Foundry & Furnace Co., Bloomington, Ill.
Arcweld Mfg. Co., Inc., Seattle, Wash.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Beck Engineering Combustion Kompany, St. Louis, Mo.
Bryant Heater Co., The, Cleveland, O.
Campbell Heating Co., Des Moines, Ia.
Campbell Heating Co., E. K., Kansas City, Mo.
Essick Mfg. Co., Los Angeles, Cal.
Forest City Foundries Co., Cleveland, O.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
Majestic Co., Huntington, Ind.
McCann Furnace Co., Cleveland, O.
McLouth Air Conditioning Corp., Lansing, Mich.
McPherson Furnace & Supply Co., Portland, Ore.
Moncrief Furnace Co., Atlanta, Ga.
Montag Stove & Furnace Wks., Portland, Ore.
Mueller Furnace Co., L. J., Milwaukee, Wis.
New York Blower Co., Chicago, Ill.
Palmer's Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Rosebraugh Co., W. W., Salem, Ore.
Western Furnaces, Inc., Tacoma, Wash.
XXth Century Heating & Ventilating Co., Akron, O.
●Zink Co., John, Tulsa, Okla.

GAGES, AIR FILTER

Air Filter Engineering Co., Chicago, Ill.
●American Air Filter Co., Inc., Louisville, Ky. (Whistling device)
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Friez & Sons, Julien P., Div of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Herbusch Corp., The, St. Louis, Mo. (Warning device)
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.

GAGES, INDICATING, DRAFT

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Dwyer Mfg. Co., F. W., Chicago, Ill.
Ellison Draft Gage Co., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Preferred Utilities Mfg. Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
●Spence Engrg. Co., Inc., Walden, N. Y.
Uehling Instrument Co., Paterson, N. J.

GAGES, INDICATING, PRESSURE

Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
●Taylor Instrument Companies, Rochester, N. Y.
Triplex Mfg. Co., Peru, Ind.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

GAGES, INDICATING, VACUUM

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Belfield Co., H., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Meriam Co., The, Cleveland, O.
Moeller Instrument Co., Richmond Hill, N. Y.
Mouat Vapor Heating Co., The, Cleveland, O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

GAGES, LIQUID LEVEL

American Injector Co., Detroit, Mich.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Boston Auto Gage Co., Pittsfield, Mass.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Caldwell Co., W. E., Louisville, Ky.
Defender Automatic Regulator Co., St. Louis, Mo.
●Detroit Lubricator Co., Detroit, Mich.
Diamond Power Specialty Corp., Detroit, Mich.
Foxboro Co.. Foxboro, Mass.
●Frick Co., Waynesboro, Pa.
Huyette Co., Inc., Paul B., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 282.

Keckley Co., O. C., Chicago, Ill.
King Engineering Corp., Ann Arbor, Mich.
Klingerit, Inc., New York, N. Y.
Liquidometer Corp., Long Island City, N. Y.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Nason Co., Detroit, Mich.
Petrometer Corp., Long Island City, N. Y.
Powell Co., Wm., Cincinnati, O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Reliance Gauge Column Co., Cleveland, O.
Republic Flow Meters Co., Chicago, Ill.
Rochester Mfg. Co., Rochester, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
●Taylor Instrument Companies, Rochester, N. Y.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.
Viking Pump Co., Cedar Falls, Ia.
Williams Gauge Co., Pittsburgh, Pa. (Water)
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

GALVANIZED SHEETS
See Sheets, Steel, Galvanized

GALVANNEALED SHEETS
See Sheets, Steel, Galvannealed

GAS BURNERS
See Burners, Gas

GAS ENGINES
See Engines, Gas

GAS PRESSURE REGULATORS
See Regulators, Pressure, Gas

GASKETS
Akron Metallic Gasket Co., Akron, O. (Metal & metal asbestos)
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Anchor Packing Co., Philadelphia, Pa. (Asbestos)
●Armstrong Cork Co., Lancaster, Pa. (Cork & cork composition)
Azor Corp., Newark, N. J. (Spiral wound)
Belmont Smelting & Refining Works, Inc., Brooklyn, N. Y. (Lead)
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Chicago-Wilcox Mfg. Co., Chicago, Ill.
Clow & Sons, James B., Chicago, Ill.
Continental Diamond Fibre Co., Newark, Del.
Continental Rubber Wks., Erie, Pa.
●Crane Co., Chicago, Ill.
Crane Packing Co., Chicago, Ill.
Darcoid Co., Inc., New York, N. Y. (Asbestos)
Durabla Mfg. Co., New York, N. Y. (Asbestos fibre)
●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Endura Mfg. Corp., Quakertown, Pa. (Paper, fibre)
Excelsior Leather Washer Co., Rockford, Ill.
Felt Products Mfg. Co., Chicago, Ill. (Heat and oil resisting)
Flexatalic Gasket Co., Camden, N. J. (Metal, asbestos)
Garlock Packing Co., Palmyra, N. Y. (Rubber, asbestos, fibre, semi-metallic)
Gatke Corp., Chicago, Ill.
Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
Goodrich Co., B. F., Akron, O. (Rubber, asbestos, synthetics)
●Grant Wilson, Inc., Chicago, Ill. (Asbestos)
Graton & Knight Co., Worcester, Mass. (Leather)
Houghton & Co., E. F., Philadelphia, Pa. (Leather)
●Jenkins Bros., New York, N. Y. (Ring asbestos or rubber sheet)
Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
Klingerit, Inc., New York, N. Y.
Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., Passaic, N. J.
Metallo Gasket Co., New Brunswick, N. J. (Metal, metal asbestos)
Miller Rubber Co., Inc., Akron, O.
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Quaker Rubber Corp., Philadelphia, Pa.
Resistoflex Corp., Belleville, N. J. (Synthetic resin)
Ruberoid Co., New York, N. Y. (Asbestos)
Smooth-On Mfg. Co., Jersey City, N. J. (Corrugated iron)
Steel Improvement & Forge Co., Cleveland, O.
Stokes Rubber Co., Jos., Trenton, N. J. (Hard rubber)
Union Asbestos & Rubber Co., Cicero, Ill.
United States Rubber Co., New York, N. Y. (Rubber, asbestos)
●Western Felt Wks., Chicago, Ill. (Felt)
●Wilson, Inc., Grant, Chicago, Ill. (Asbestos)

GATE VALVES
See Valves, Gate

GLASS PIPE
See Pipe, Glass

GLOBE VALVES
See Valves, Globe

GOVERNORS, PUMP
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Gardner-Denver Co., Quincy, Ill.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Equipment Co., Erie, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.

GRILLES
Air Control Products, Inc., Muskegon, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
●Auer Register Co., Cleveland, O.
Barber-Colman Co., Rockford, Ill.
Beckley Perforating Co., Garwood, N. J.
Best Register Co., Milwaukee, Wis.
Central Wire & Iron Works, Des Moines, Ia.
Char-Gale Mfg. Co., Minneapolis, Minn.
Chicago Perforating Co., Chicago, Ill.
Cincinnati Mfg. Co., Cincinnati, O.
Cross Engineering Co., Carbondale, Pa.
Crown Iron Works, Minneapolis, Minn.
Decatur Iron & Steel Co., Decatur, Ala.
Diamond Mfg. Co., Wyoming, Pa.
Erdle Perforating Co., Rochester, N. Y.
Falstrom Co., Passaic, N. J.
Gillian Mfg. Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Harrington & King Perforating Co., Chicago, Ill.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Jamieson Mfg. Co., Dallas, Tex.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Lamneck Products, Inc., Middletown, O.
Lockjoint Wood Products Co., Wichita, Kans. (Wood)
Manhattan Perforated Metal Co., Inc., Long Island City, N. Y.
Metalace Corp., So. Boston, Mass.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Mundt & Sons, Charles, Jersey City, N. J.
Newman Brothers, Inc., Cincinnati, O.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Reliable Perforating Co., Chicago, Ill.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
Standard Stamping & Perforating Co., Chicago, Ill.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
●Waterloo Register Co., Waterloo, Ia.
Western Wire & Iron Works, Inc., Chicago, Ill.
Wickwire Spencer Steel Co., New York, N. Y.

GUNS AND POTS, SMOKE AND SMUDGE, FOR TESTING AIR MOVEMENT
Hill, E. Vernon, Chicago, Ill.
Newman Co., Inc., I. C., New York, N. Y.
Pains Fireworks Display Co., New York, N. Y.

HAND SHEARS
See Shears and Snips, Hand

● Advertisement in this issue. See Index to Advertisers, page 282.

HANGERS OR BRACKETS, RADIATOR

American Foundry & Furnace Co., Bloomington, Ill.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Carpenter & Paterson, Inc., East Boston, Mass.
Carty & Moore Engineering Co., Detroit, Mich.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy Ruff Co., St. Paul, Minn.
Inland Mfg. Co., Chicago, Ill. (Unit heater hangers)
Jennison Co., Fitchburg, Mass. (Adjustable radiator foot rest)
Logansport Radiator Equipment Co., Logansport, Ind.
●McAlear Mfg. Co., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Paine Co., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Sterling, Inc., Milwaukee, Wis.
United States Radiator Corp., Detroit, Mich.
Western Hanger Co., San Francisco, Cal.

HANGERS AND SUPPORTS, PIPE

●American District Steam Co., North Tonawanda, N. Y.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Carpenter & Paterson, Inc., East Boston, Mass.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Crawford Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Valve & Mfg. Co., Pittsburgh, Pa.
Paine Co., Chicago, Ill.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Reznor Mfg. Co., Mercer, Pa.
●Ric-wiL Co., Cleveland, O. (Underground)
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Semler Co., Jeannette, Pa.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Western Wire Products Co.. St. Louis, Mo.

HARD RUBBER PIPE

See Pipe and Fittings, Hard Rubber

HEADERS, WELDED

●Acme Industries, Inc., Jackson, Mich.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Chicago Nipple Mfg. Co., Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
●Crane Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●Grinnell Co., Inc., Providence, R. I.
International Engineering Wks., Inc., Framingham, Mass.
Kellogg Co., M. W., The, New York, N. Y.
Limbert & Co., Geo. B., Chicago, Ill.
Lumsden & Van Stone Co., South Boston, Mass.
●Midwest Piping & Supply Co., Inc., St. Louis, Mo.
National Pipe Bending Co., New Haven, Conn.
National Valve & Mfg. Co., Pittsburgh, Pa.
Naylor Pipe Co., Chicago, Ill.
Ohio Pipe Bending & Mach. Co., Cleveland, O.
Philadelphia Pipe Bending Co., Philadelphia, Pa.
Pittsburgh Pipe Coil & Bending Co., Etna, Pa.
Pittsburgh Piping & Equipment Co., Pittsburgh, Pa.
Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa.
Rempe Co., Chicago, Ill.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Sales & Co., Murray W., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Shaw Co., Benjamin F., Wilmington, Del.
Shaw-Kendall Engineering Co., Toledo, O.
Walworth Co., New York, N. Y.

HEADS, SPRINKLER

●Binks Mfg. Co., Chicago, Ill.
Cleghorn Co., Boston, Mass.
●Grinnell Co., Inc., Providence, R. I.
Hodgman Mfg. Co., Taunton, Mass.
Northern Indiana Brass Co., Elkhart, Ind.
Raisler Sprinkler Co., New York, N. Y.
Rockwood Sprinkler Co.. Worcester, Mass.

HEAT EXCHANGERS

See Chillers, Water; Condensers, Refrigerating; Surface, Cooling; Surface, Heating

HEATERS, AIR, DIRECT FIRED

●Airtherm Mfg. Co., St. Louis, Mo.
American Furnace Co., St. Louis, Mo.
Campbell Heating Co., Des Moines, Ia.
Despatch Oven Co., Minneapolis, Minn.
Dravo Corp., Pittsburgh, Pa.
Faraday Engineering Co., Boston, Mass.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Jackson & Church Co., Saginaw, Mich.
Lee Engineering Co., Youngstown, O.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
McCann Furnace Co., Cleveland, O.
Nelson Co., Detroit, Mich.
New York Blower Co., Chicago, Ill.
Palmer's Mfg. Corp., Phoenix, Ariz.
Reznor Mfg. Co., Mercer, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Smith, Inc., James Campbell, Cleveland, O.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
●Surface Combustion Corp., Toledo, O.
Thermal Engineering Associates, Chicago, Ill.
Williams, Inc., F. C., Dearborn, Mich.

HEATERS, DUCT, ELECTRIC

Consolidated Car-Heating Co., Inc., Albany, N. Y.
Despatch Oven Co., Minneapolis, Minn.
General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Tenney Engineering, Inc., Bloomfield, N. J.
Trent Co., Harold E., Philadelphia, Pa.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, DUCT, GAS

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Bryant Heater Co., The, Cleveland, O.
●Carrier Corp., Syracuse, N. Y.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer's Mfg. Corp., Phoenix, Ariz.
Reznor Mfg. Co., Mercer, Pa.
Utility Fan Corp., Los Angeles, Cal.

HEATERS, STRIP AND IMMERSION, ELECTRIC

American Instrument Co., Silver Spring, Md.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cutler-Hammer, Inc., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa
Purdue Associates, Albert G., New Haven, Conn. (Electric pipe line heaters)
Red Spot Electric Co., Tacoma, Wash.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, ELECTRIC HEATING ELEMENT

Autovent Fan & Blower Co., Chicago, Ill.
●Burnham Boiler Corp., Irvington, N. Y. (Radiator)
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Electric Air Heater Co., Div. American Foundry Equipment Co., Mishawaka, Ind.
Hynes Electric Heating Co., Philadelphia, Pa.
●Ilg Electric Ventilating Co., Chicago, Ill.
Red Spot Electric Co., Tacoma, Wash.
Samson-United Corp., Rochester, N. Y.
Tenney Engineering, Inc., Bloomfield, N. J.
Trent Co., Harold E., Philadelphia, Pa.
Vulcan Electric Co., Lynn, Mass.
Warren Electric Appliance Co., Warren, Pa.
Westinghouse Electric & Mfg. Co., Mansfield, O.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

HEATERS, UNIT, GAS FIRED

Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Automatic Gas Equipment Co., Pittsburgh, Pa.
Bryant Heater Co., The, Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
Continental Stove Corp., Ironton, O.
General Gas Light Co., Kalamazoo, Mich.
McCann Furnace Co., Cleveland, O.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Pacific Gas Radiator Co., Huntington Park, Cal.
Reznor Mfg. Co., Mercer, Pa.
Ross Engineering Corp., J. O., New York, N. Y.
Schoedinger, F. O., Columbus, O.
●Surface Combustion Corp., Toledo, O.
●Trane Co., La Crosse, Wis.
Utility Fan Corp., Los Angeles, Cal.

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HEATERS, UNIT, STEAM AND HOT WATER

●Airtherm Mfg. Co., St. Louis, Mo.
American Blower Corp., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
●Beacon-Morris Corp., Boston, Mass.
Berns Specialty Co., Chicago, Ill.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., E. K., Kansas City, Mo.
●Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hartzell Propeller Fan Co., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Industrial Mfg. & Engrg. Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Johnson Fan & Blower Corp., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis. Minn.
●Modine Mfg. Co., Racine, Wis.
Murray Iron Wks. Co., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
National Radiator Co., The, Johnstown, Pa.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Richmond Engineering Co., Inc., Richmond, Va.
Rome-Turney Radiator Co., Rome, N. Y.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
●Webster & Co., Warren, Camden, N. J.
Western Blower Co., Seattle, Wash.
●Wing Mfg. Co., L. J., New York, N. Y.
●Young Radiator Co., Racine, Wis.

HEATERS, WATER, CAST IRON, COAL FIRED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Cleghorn Co., Boston, Mass.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Glore Sales Corp., Evins F., New York, N. Y.
Hart & Crouse Corp., Utica, N. Y.
International Heater Co., Utica, N. Y.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Pipe Bending Co., New Haven, Conn.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Schwitzer-Cummins Co., Indianapolis, Ind.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
Thatcher Furnace Co., Newark, N. J.
Weil-McLain Co., Chicago, Ill.

HEATERS, WATER, GAS FIRED

American Bosch Corp., Springfield, Mass.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bryant Heater Co., The, Cleveland, O.
●Crane Co., Chicago, Ill.
Dahlquist Mfg. Co., Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Handley Brown Heater Co., Jackson, Mich.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
Montgomery Bros., San Francisco, Cal.
Mueller Furnace Co., L. J., Milwaukee, Wis.
National Radiator Co., The, Johnstown, Pa.
Pacific Gas Radiator Co., Huntington Park, Cal.
Pittsburgh Water Heater Co., Pittsburgh, Pa.
Richmond Radiator Co., Uniontown, Pa.
Rotary Mfg. Co., Los Angeles, Cal.
Ruud Mfg. Co., Pittsburgh, Pa.
Schoedinger, F. O., Columbus, O.
United States Radiator Corp., Detroit, Mich.

HEATERS, WATER, INDIRECT

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Automatic Stoker Corp., Milwaukee, Wis.
●Bell & Gossett Co., Chicago, Ill.
Bryan Steam Corp., Peru, Ind.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Davis Engineering Corp., Elizabeth, N. J.
Ferguson & Lange Foundry Co., Chicago, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Hotstream Heater Co., Cleveland, O.
Kehm Corp., The, Chicago, Ill.
Koven & Bro., Inc., L. O., Jersey City, N. J.
Little Mfg. Co., M. S., Hartford, Conn.
Marion Machine Foundry & Supply Co., Marion, Ind.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling, Inc., Milwaukee, Wis.
Taco Heaters, Inc., New York, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Vapor Car Heating Co., Inc., Chicago, Ill.

HEATERS, WATER, OIL FIRED

Bethlehem Foundry & Machine Co., Bethlehem, Pa.
Cleaver-Brooks Co., Milwaukee, Wis.
Delco Appliance Co., Rochester, N. Y.
Electrol, Inc., Clifton, N. J.
Gerstein & Cooper Co., South Boston, Mass.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Glore Sales Corp., Evins F., New York, N. Y.
Hotstream Heater Co., Cleveland, O.
International Engineering Wks., Inc., Framingham, Mass.
Johnson Co., S. T., Oakland, Cal.
Littleford Bros., Cincinnati, O.
National Radiator Co., The, Johnstown, Pa.
Nu-Way Corp., Rock Island, Ill.
Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
Ray Oil Burner Co., San Francisco, Cal.
Reif-Rexoil, Inc., Buffalo, N. Y.
Scott-Newcomb, Inc., St. Louis, Mo.
Smith Co., Inc., H. B., The, Westfield, Mass.
Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.
United States Radiator Corp., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wayne Oil Burner Corp., Fort Wayne, Ind.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Oil Burner Co., Inc., York, Pa.

HEATERS, WATER, STEAM, INSTANTANEOUS

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Davis Engineering Corp., Elizabeth, N. J.
Eclipse Fuel Engineering Co., Rockford, Ill.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
General Furnaces Corp., New York, N. Y.
Gerstein & Cooper Co., South Boston, Mass.
Griscom-Russell Co., The, New York, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
Johnson Corp., Three Rivers, Mich.
Marion Machine Foundry & Supply Co., Marion, Ind.
Montgomery Bros., San Francisco, Cal.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Works, Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., Erie, Pa.
Sterling, Inc., Milwaukee, Wis.
Super Radiator Corp., Minneapolis, Minn.
Swartwout Co., Cleveland, O.
Taco Heaters, Inc., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.
●Whitlock Mfg. Co., Hartford, Conn.

HEATERS, WATER, STEAM, STORAGE

Akwa Heaters, Inc., New York, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Bigelow Co., New Haven, Conn.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
●Burnham Boiler Corp., Irvington, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 282.

- Dahlquist Mfg. Co., Inc., Boston, Mass.
- Davis Engineering Co., Elizabeth, N. J.
- Frank Heaters, Inc., Paterson, N. J.
- General Fittings Co., Providence, R. I.
- Gerstein & Cooper Co., South Boston, Mass.
- Griscom-Russell Co., The, New York, N. Y.
- Howard Iron Wks. & Alberger Heater Co., Buffalo, N. Y.
- Hynes Electric Heating Co., Philadelphia, Pa.
- International Engineering Wks., Inc., Framingham, Mass.
- Johnson Corp., Three Rivers, Mich.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Koven & Bro., Inc., L. O., Jersey City, N. J.
- Manitowoc Boiler Wks., Manitowoc, Wis.
- Marion Machine Foundry & Supply Co., Marion, Ind.
- Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
- National Pipe Bending Co., New Haven, Conn.
- ●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
- Quaker City Iron Works, Philadelphia, Pa.
- Richmond Engineering Co., Inc., Richmond, Va.
- Rockwood Sprinkler Co., Worcester, Mass.
- Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
- Rotary Mfg. Co., Los Angeles, Cal.
- Sims Co., Erie, Pa.
- Super Radiator Corp., Minneapolis, Minn.
- Taco Heaters, Inc., New York, N. Y.
- Vogt Machine Co., Henry, Louisville, Ky.
- Warren Electric Appliance Co., Warren, Pa. (Electric)
- ●Whitlock Mfg. Co., Hartford, Conn.

HEATERS, WATER, STEEL, COAL FIRED

- Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
- ●Fitzgibbons Boiler Co., New York, N. Y.
- International Engineering Wks., Inc., Framingham, Mass.
- Johnson Bros., Inc., Ferrysburg, Mich.
- ●Kewanee Boiler Corp., Kewanee, Ill.
- Lookout Boiler & Mfg. Co., Chattanooga, Tenn.
- National Radiator Co., The, Johnstown, Pa.
- Pacific Steel Boiler Div., United States Radiator Corp., Detroit, Mich.
- Spencer Heater Div., Aviation Mfg. Corp., Williamsport, Pa.

HEATING BOILERS

See Boilers, Heating

HEATING COILS

See Surface, Heating

HEATING SURFACE

See Surface, Heating

HOSE, METAL, FOR ELIMINATING COMPRESSOR VIBRATION

- American Metal Hose Branch, American Brass Co., Waterbury, Conn.
- Atlantic Metal Hose Co., Inc., New York, N. Y.
- Chicago Metal Hose Corp., Maywood, Ill.
- ●Eclipse Aviation, Div. of Bendix Aviation Corp., Bendix, N. J.
- Pennsylvania Flexible Metallic Tubing Co., Philadelphia, Pa.
- Seamlex Co., Inc., Long Island City, N. Y.
- Titeflex Metal Hose Co., Newark, N. J.
- United Metal Hose Co., Inc., Long Island City, N. Y.

HOT WATER HEATING SYSTEMS

See Systems, Heating, Hot Water

HOT WATER PRESSURE REGULATORS

See Regulators, Pressure, Hot Water Heating Systems

HOUSINGS, FAN, CENTRIFUGAL

- ●Air Controls, Inc., Cleveland, O.
- Brundage Co., Kalamazoo, Mich.
- ●Commercial Shearing & Stamping Co., Youngstown, O.
- Detroit Stamping Co., Detroit, Mich.
- Economy Electric Mfg. Co., Chicago, Ill.
- General Blower Corp., San Francisco, Cal.
- Hastings Air Conditioning Co., Inc., Hastings, Nebr.
- ●Lau Blower Co., Dayton, O.
- National Mfg. & Engineering Co., Detroit, Mich.
- Sandberg Sheet Metal Works, Portland, Ore.
- Schwitzer-Cummins Co., Indianapolis, Ind.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- Viking Air Conditioning Corp., Cleveland, O.

HOUSINGS, FAN, PROPELLER

- ●Commercial Shearing & Stamping Co., Youngstown, O.

HUMIDIFIERS, CENTRAL PLANT

- ●Air & Refrigeration Corp., New York, N. Y.
- American Blower Corp., Detroit, Mich.
- ●Armstrong Machine Wks., Three Rivers, Mich.
- ●Barber-Colman Co., Rockford, Ill.
- Brundage Co., Kalamazoo, Mich.
- ●Carrier Corp., Syracuse, N. Y.
- ●Clarage Fan Co., Kalamazoo, Mich.
- ●Johnson Service Co., Milwaukee, Wis.
- Mellish & Murray Co., Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Monmouth Products Co., Cleveland, O.
- Parks-Cramer Co., Fitchburg, Mass.
- Powers Regulator Co., Chicago, Ill.
- Research Corp., New York, N. Y.
- Ross Engineering Corp., J. O., New York, N. Y.
- Southworth Machine Co., Portland, Me.
- Spray-Wheel Air Conditioners, Inc., Denver, Colo.
- Steamaire Co., Cincinnati, O.
- Strandwitz & Co., Inc., W. J., Camden, N. J.
- Sturtevant Co., B. F., Hyde Park, Boston, Mass.
- ●Surface Combustion Corp., Toledo, O.
- ●Trane Co., La Crosse, Wis.
- Viking Air Conditioning Corp., Cleveland, O.

HUMIDIFIERS, DIRECT, SPRAY HEAD

- American Moistening Co., Providence, R. I.
- Ames Co., W. R., San Francisco, Cal.
- Anetsberger Bros., Chicago, Ill.
- Bahnson Co., Winston-Salem, N. C.
- Betz Air Conditioning Corp., Kansas City, Mo.
- ●Binks Mfg. Co., Chicago, Ill.
- Blower Application Co., Milwaukee, Wis.
- ●Buffalo Forge Co., Buffalo, N. Y.
- Chelsea Fan & Blower Co., New York, N. Y.
- International Moistening Co., Providence, R. I.
- Lohman, Inc., Wm. J., New York, N. Y.
- Manufacturers Machine Co., North Andover, Mass.
- ●Marley Co., Kansas City, Mo.
- Mellish & Murray Co., Chicago, Ill.
- ●Murray Mfg. Co., D. J., Wausau, Wis.
- New York Blower Co., Chicago, Ill.
- Parks-Cramer Co., Fitchburg, Mass.
- Pfening Co., Fred D., Columbus, O.
- Rhode Island Humidifier & Ventilating Co., Boston, Mass.
- Ross Sprinkler Co., Pasadena, Cal.
- Somers, Inc., H. J., Detroit, Mich.
- Southworth Machine Co., Portland, Me.
- Spray Engineering Co., Somerville, Mass.
- ●Spraying Systems Co., Chicago, Ill.
- Steamaire Co., Cincinnati, O.
- Supreme Electric Products Corp., Rochester, N. Y.

HUMIDIFIERS FOR RADIATORS AND CONVECTORS

- ●Maid-O-Mist, Inc., Chicago, Ill.
- ●McDonnell & Miller, Chicago, Ill.
- ●Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, RADIATOR VENT VALVE

- ●Maid-O-Mist, Inc., Chicago, Ill.
- ●Skilbeck Mfg. Co., Kenosha, Wis.

HUMIDIFIERS, UNIT, ROOM TYPE (Without Heating)

- Alter Co., Harry, Chicago, Ill.
- Betz Air Conditioning Corp., Kansas City, Mo.
- ●Carrier Corp., Syracuse, N. Y.
- Certified Products Co., Toledo, O.
- Coolmaster Corp., Chicago, Ill.
- Corozone Air Conditioning Corp., Cleveland, O.
- Cugley Incubator Co., Elkhart, Ind.
- Hugo Mfg. Co., Duluth, Minn.
- Kauffman Air Conditioning Corp., St. Louis, Mo.
- Lion Mfg. Corp., Chicago, Ill.
- Little Giant Vaporizer Co., Oklahoma City, Okla.
- Lohman, Inc., Wm. J., New York, N. Y.
- Lowell Air Conditioning Corp., Philadelphia, Pa.
- Norwood Filtration Co., The, Florence, Mass.
- ●Skilbeck Mfg. Co., Kenosha, Wis.
- Somers, Inc., H. J., Detroit, Mich.
- Southworth Machine Co., Portland, Me.
- Spray-Wheel Air Conditioners, Inc., Denver, Colo.
- Standard Engineering Wks., Pawtucket, R. I.
- Steamaire Co., Cincinnati, O.
- ●U. S. Air Conditioning Corp., Minneapolis, Minn.
- Vigor-Aire Corp., Philadelphia, Pa.

HUMIDIFYING RADIATORS

See Radiators, Humidifying

HUMIDISTATS

- American Moistening Co., Providence, R. I.
- Atlas Valve Co., Inc., Newark, N. J.
- Au-Temp-Co Corp., New York, N. Y.
- Bahnson Co., Winston-Salem, N. C.
- Barber-Colman Co., Rockford, Ill.
- Bristol Co., Waterbury, Conn.
- ●Detroit Lubricator Co., Detroit, Mich.
- Foxboro Co., Foxboro, Mass.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- G. M. Mfg. Co., New York, N. Y.
- ●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
- H-B Instrument Co., Philadelphia, Pa.
- ●Johnson Service Co., Milwaukee, Wis.
- Leeds & Northrup Co., Philadelphia, Pa.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Parks-Cramer Co., Fitchburg, Mass.
- Penn Electric Switch Co., Goshen, Ind.
- Powers Regulator Co., Chicago, Ill.
- Spencer Thermostat Co., Attleboro, Mass.
- Standard Engineering Wks., Pawtucket, R. I.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.
- White-Rodgers Electric Co., St. Louis, Mo.

● Advertisement in this issue. See Index to Advertisers, page 282.

HUMIDITY RECORDERS
See Recorders, Humidity

HUMIDITY AND TEMPERATURE CONTROLS
See Humidistats; Recorder-Controllers; Thermostats

HYDRAULIC SPEED CHANGERS
See Changers, Speed, Hydraulic Coupling

HYGROMETERS
American Moistening Co., Providence, R. I.
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bahnson Co., Winston-Salem, N. C.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
International Moistening Co., Providence, R. I.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Weksler Thermometer Corp., New York, N. Y.

HYGROSTATS
See Humidistats

IMMERSION THERMOSTATS
See Thermostats, Immersion

INDICATING THERMOMETERS
See Thermometers, Indicating

INDICATOR-CONTROLLERS, PRESSURE
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.

INDICATOR-CONTROLLERS, RELATIVE HUMIDITY
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

INDICATOR-CONTROLLERS, TEMPERATURE
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
●Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.

INDICATORS, CARBON DIOXIDE, BOILER ROOM
For portable CO_2 analyzers, see Analyzers, Carbon Dioxide, Portable

Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Chas., Newark, N. J.
●Hays Corp., Michigan City, Ind.
Leeds & Northrup Co., Philadelphia, Pa.
Weaver Mfg. Co., Springfield, Ill.

INDICATORS, SOUND LEVEL
General Electric Co., Schenectady, N. Y.

INDIRECT HEATING SURFACE
See Surface, Heating

INDIRECT WATER HEATERS
See Heaters, Water, Indirect

INDUSTRIAL AIR CONDITIONERS
See Units, Air Conditioning, Industrial Type

INSTANTANEOUS WATER HEATERS
See Heaters, Water, Steam, Instantaneous

INSULATION, BOILER AND TANK
Acme Asbestos Covering & Flooring Co., Chicago, Ill.
Alfol Insulation Co., Inc., New York, N. Y. (Aluminum foil)
Aluminum Aircell Insulation Co., Detroit, Mich.
●Armstrong Cork Co., Lancaster, Pa.
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barrett Co., The, New York, N. Y.
●Carey Co., Philip, Lockland, Cincinnati, O.
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Cork)
Eagle-Picher Lead Co., Cincinnati, O.
●Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Magnesia)
General Insulating & Mfg. Co., St. Louis, Mo.
●Grant Wilson, Inc., Chicago, Ill.
International Vermiculite Co., Springfield, Ill.
Jamar Co., Walker, Duluth, Minn.
Johns-Manville, New York, N. Y.
Keasbey Co., Robert A., New York, N. Y. (Asbestos)
Keasbey & Mattison Co., Ambler, Pa.
Krehbiel Co., J. H., Chicago, Ill.
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Munn and Steele, Inc., Newark, N. J.
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and magnesia)
●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Refractory & Insulation Corp., New York, N. Y. (Blanket, block, cement)
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill.
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler, Inc., Elizabeth, N. J.
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime and Stone Co., Baltimore, Md. (Rock wool)
Therminsul Corp., Kalamazoo, Mich. (Felted block)
Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Co., Kearney, N. J. (Cork)
Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
Walker Jamar Co., Duluth, Minn.
●Wilson, Inc., Grant, Chicago, Ill.

INSULATION, BUILDING
Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Rock wool)
Air-O-Cel Industries, Inc., Detroit, Mich.
Alfol Insulation Co., New York, N. Y. (Aluminum foil)
Alton Mineral Wool Insulation Co., Alton, Ill.
Aluminum Aircell Insulation Co., Detroit, Mich.
American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
American Hair & Felt Co., Chicago, Ill. (Hair felt)
●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
Bache & Co., Semon, New York, N. Y. (Glass wool)
Baldwin-Hill Co., Trenton, N. J. (Rock wool)
Barber Asphalt Corp., Barber, N. J.
Barrett Co., The, New York, N. Y.
Berry, Jr. & Co., Inc., F. E., Boston, Mass.
Butterworth, Jr., B. T., New Canaan, Conn. (Cork)
Cabot, Inc., Samuel, Boston, Mass.(Flexible)
●Carey Co., Philip, Lockland, Cincinnati, O. (Rock wool)
Celotex Corp., The, Chicago, Ill.
Certain-teed Products Corp., New York, N. Y. (Board, reflective)
Chamberlin Metal Weather Strip Co., Detroit, Mich. (Rock wool)
●Cork Import Corp., New York, N. Y. (Cork)
Cork Insulation Co., Inc., New York, N. Y. (Corkboard)
Crown Cork & Seal Co., Baltimore, Md.
Doheny Co., John J., Belmont, Mass. (Blanket)
Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool, blankets, batts, granulated, loose)
Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
Flintkote Co., New York, N. Y. (Fiber board and rock wool)
General Insulating & Mfg. Co., St. Louis, Mo. (Loose fill-Blanket-Bat)
General Insulating Products Co., Brooklyn, N. Y. (Rock wool)
●Grant Wilson, Inc., Chicago, Ill. (Rockwool)
Hinde & Dauch Paper Co., Sandusky, O.
Insulite Co., Minneapolis, Minn. (Wood fibre)
Insul-Wool Insulation Corp., Wichita, Kan.
International Vermiculite Co., Springfield, Ill. (Loose fill)
Johns-Manville, New York, N. Y. (Rock wool and wood fibreboard)
Johnston Tin Foil & Metal Co., St. Louis, Mo. (Foil, aluminum, tin, lead)

● Advertisement in this issue. See Index to Advertisers, page 282.

- Keasbey Co., Robert A., New York, N. Y. (Rock wool)
- Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
- Kimberly-Clark Corp., Neenah, Wis.
- Marblehead Lime Co., Chicago, Ill. (Rock wool)
- Masonite Corp., Chicago, Ill. (Fibre board)
- Masonite Corp., Cellufoam Products Div., Chicago, Ill.
- Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
- Mitchell & Smith, Inc., Detroit, Mich. (Cork)
- ●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
- Munn and Steele, Inc., Newark, N. J.
- National Gypsum Co., Buffalo, N. Y.
- ●Owens-Corning Fiberglas Corp., Toledo, O.
- ●Pacific Lumber Co., The, San Francisco, Cal.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Plastergon Wall Board Co., Buffalo, N. Y. (Rigid board)
- Refractory & Insulation Corp., New York, N. Y. (Rock, slag wool)
- Rock Wool Products Co., Wabash, Ind. (Loose fill)
- Ruberoid Co., New York, N. Y. (Mineral wool and aluminum foil)
- Russell Co., F. C., Cleveland, O.
- Sonner Burner Co., Winfield, Kans.
- Specialty Converters, Inc., East Braintree, Mass. (Reflective insulation)
- Sprayo-Flake Co., Chicago, Ill.
- Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hairfelt)
- Standard Lime & Stone Co., Baltimore, Md. (Rock wool)
- Therminsul Corp., Kalamazoo, Mich. (Rock wool block)
- Truscon Steel Co., Youngstown, O. (Insulation board sealed between metal sheets)
- United Cork Companies, Lyndhurst, N. J. (Cork)
- United States Gypsum Co., Chicago, Ill. (Wool and board)
- United States Mineral Wool Co., Chicago, Ill. (Mineral wool)
- Universal Gypsum & Lime Co., Chicago, Ill. (Loose fill)
- Universal Zonolite Insulation Co., Chicago, Ill. (Loose fill)
- Upson Co., Lockport, N. Y.
- Wilson & Co., Chicago, Ill. (Board)
- ●Wilson, Inc., Grant, Chicago, Ill. (Rock wool)
- Wood Conversion Co., St. Paul, Minn. (Nu-Wood board, balsam-wool blanket)

INSULATION, CEILING AND WALL, SOUND DEADENING

Acoustical treatment only—for thermal insulation, see Insulation, Building

- Air-O-Cel Industries, Inc., Detroit, Mich.
- American Hair & Felt Co., Chicago, Ill.
- ●Armstrong Cork Co., Lancaster, Pa.
- Barrett Co., The, New York, N. Y.
- Berry, Jr. & Co., F. E., Everett, Mass.
- Celotex Corp., The, Chicago, Ill.
- Doheny Co., John J., Belmont, Mass.
- Felters Co., Inc., Boston, Mass.
- Fir-Tex Insulating Board Co., St. Helens, Ore.
- General Insulating & Mfg. Co., St. Louis, Mo.
- General Insulating Products Co., Brooklyn, N. Y.
- Insulite Co., Minneapolis, Minn.
- Insul-Wool Insulation Corp., Wichita, Kan.
- Johns-Manville, New York, N. Y.
- Keasbey & Mattison Co., Ambler, Pa.
- Masonite Corp., Chicago, Ill. (Fibreboard)
- Masonite Corp., Cellufoam Products Div., Chicago, Ill.
- Mitchell & Smith, Inc., Detroit, Mich.
- ●Mundet Cork Corp., Brooklyn, N. Y.
- ●Owens-Corning Fiberglas Corp., Toledo, O.
- ●Pacific Lumber Co., The, San Francisco, Cal.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Sprayo-Flake Co., Chicago, Ill.
- Therminsul Corp., Kalamazoo, Mich.
- Upson Co., Lockport, N. Y.
- Western Silicair Products, Inc., Burbank, Cal.
- Wood Conversion Co., St. Paul, Minn. (Nu-Wood, Balsam-wool)

INSULATION, DUCT, SOUND DEADENING

For application inside duct

- American Hair & Felt Co., Chicago, Ill.
- Baldwin-Hill Co., Trenton, N. J. (Rock wool)
- Barrett Co., The, New York, N. Y.
- Berry, Jr. & Co., Inc., F. E., Everett, Mass.
- Cabot, Inc., Samuel, Boston, Mass.
- ●Carey Co., Philip, Cincinnati, O.
- Celotex Corp., The, Chicago, Ill.
- Felters Co., Inc., Boston, Mass.
- ●Grant Wilson, Inc., Chicago, Ill.
- Johns-Manville, New York, N. Y.
- Kimberly-Clark Corp., Neenah, Wis.
- Masonite Corp., Chicago, Ill.
- Masonite Corp., Cellufoam Products Div., Chicago, Ill.
- Maxim Silencer Co., Hartford, Conn.
- Mortell Co., J. W., Chicago, Ill.
- Nelson Mfg. Co., B. F. Minneapolis, Minn.
- ●Owens-Corning Fiberglas Corp., Toledo, O.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Plant Rubber & Asbestos Works, San Francisco, Cal.
- Seneca Rock Wool Co., Tiffin, O.
- Telsit Insulation Co., Bronx, N. Y.
- Universal Zonolite Insulation Co., Chicago, Ill.
- ●Western Felt Works, Chicago, Ill.
- Western Silicair Products, Inc., Burbank, Cal.
- ●Wilson, Inc., Grant, Chicago, Ill.

INSULATION, DUCT, THERMAL

- Acme Asbestos Covering & Flooring Co., Chicago, Ill. (Asbestos)
- Air-O-Cel Industries, Inc., Detroit, Mich.
- Alfol Insulation Co., New York, N. Y. (Aluminum foil)
- American Flange & Mfg. Co., Inc., New York, N. Y. (Metal sheets)
- American Hair & Felt Co., Chicago, Ill. (Hair felt)
- ●Armstrong Cork Co., Lancaster, Pa. (Corkboard, fibreboard)
- Barrett Co., The, New York, N. Y.
- Berry, Jr. & Co., Inc., F. E., Boston, Mass.
- Cabot, Inc., Samuel, Boston, Mass. (Flexible)
- ●Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos)
- Celotex Corp., The, Chicago, Ill.
- ●Cork Import Corp., New York, N. Y. (Cork)
- Cork Insulation Co., Inc., New York, N. Y. (Cork board)
- Crown Cork & Seal Co., Baltimore, Md.
- Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool blankets)
- ●Ehret Magnesia Mfg. Co., Valley Forge, Pa. (Cork, magnesia, hair felt)
- Felters Co., Inc., Boston, Mass. (Wool felt)
- Fir-Tex Insulating Board Co., St. Helens, Ore. (Wood fibreboard)
- General Insulating & Mfg. Co., St. Louis, Mo. (Block)
- General Insulating Products Co., Brooklyn, N. Y. (Acoustic rock wool)
- ●Grant Wilson, Inc., Chicago, Ill.
- Insulite Co., Minneapolis, Minn. (Wood fibre)
- International Vermiculite Co., Springfield, Ill. (Block)
- Johns-Manville, New York, N. Y. (Rock cork, asbestos)
- Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
- Keasbey & Mattison Co., Ambler, Pa. (Asbestos)
- Kimberly-Clark Corp., Neenah, Wis.
- Masonite Corp., Chicago, Ill. (Fibreboard)
- Masonite Corp., Cellufoam Products Div., Chicago, Ill.
- Miller Rubber Co., Inc., Akron, O.
- Mineral Insulation Co., Chicago Ridge, Ill. (Rock wool)
- Mitchell & Smith, Inc., Detroit, Mich. (Cork)
- ●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
- Munn and Steele, Inc., Newark, N. J.
- Nelson Mfg. Co., B. F., Minneapolis, Minn.
- Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos and wool felt)
- ●Owens-Corning Fiberglas Corp., Toledo, O. (Blanket)
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Plant Rubber & Asbestos Works, San Francisco, Cal.
- Presstite Engineering Co., St. Louis, Mo. (Adhesive)
- Refractory & Insulation Corp., New York, N. Y. (Block, blanket)
- Rock Wool Products Co., Wabash, Ind.
- Ruberoid Co., New York, N. Y. (Asbestos cellular and laminated sheets or blocks)
- Russell Co., F. C., Cleveland, O.
- Sall Mountain Co., Chicago, Ill. (Asbestos)
- Schundler & Co., Inc., F. E., Long Island City, N. Y.
- Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell type)
- Sprayo-Flake Co., Chicago, Ill.
- Standard Asbestos Mfg. Co., Chicago, Ill. (Asbestos, hair felt)
- Telsit Insulation Co., Bronx, N. Y.
- Therminsul Corp., Kalamazoo, Mich. (Rock wool bats, loose and granulated)
- United Cork Companies, Lyndhurst, N. J. (Cork)
- United States Mineral Wool Co., Chicago, Ill.
- Universal Zonolite Insulation Co., Chicago, Ill. (Plastic)
- ●Western Felt Wks., Chicago, Ill. (Felt)
- Wilson & Co., Chicago, Ill. (Flexible)
- ●Wilson, Inc., Grant, Chicago, Ill.
- Wood Conversion Co., St. Paul, Minn. (Balsam-wool)

INSULATION, PIPE

- Acme Asbestos Covering & Flooring Co., Chicago, Ill.
- Alfol Insulation Co., New York, N. Y. (Aluminum foil)
- ●American District Steam Co., North Tonawanda, N. Y. (Underground)
- American Hair & Felt Co., Chicago, Ill.
- ●Armstrong Cork Co., Lancaster, Pa. (Cork)
- Baldwin-Hill Co., Trenton, N. J. (Rock wool)
- Barrett Co., The, New York, N. Y.
- ●Carey Co., Philip, Lockland, Cincinnati, O. (Asbestos, magnesia)
- ●Cork Import Corp., New York, N. Y. (Cork)
- Cork Insulation Co., New York, N. Y.
- Eagle-Picher Lead Co., Cincinnati, O. (Mineral wool)
- ●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- General Insulating & Mfg. Co., St. Louis, Mo. (Moulded)
- ●Grant Wilson, Inc., Chicago, Ill.
- International Vermiculite Co., Springfield, Ill. (Vermiculite)
- Jamar Co., Walker, Duluth, Minn.
- Johns-Manville, New York, N. Y. (Asbestos, magnesia, rock cork)
- Keasbey Co., Robert A., New York, N. Y. (Asbestos and cork)
- Keasbey & Mattison Co., Ambler, Pa. (Asbestos, magnesia)

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Miller Rubber Co., Inc., Akron, O. (Sponge rubber)
Mitchell & Smith, Inc., Detroit, Mich. (Cork)
●Mundet Cork Corp., Brooklyn, N. Y. (Cork)
Norristown Magnesia & Asbestos Co., Norristown, Pa. (Asbestos, magnesia)
●Owens-Corning Fiberglas Corp., Toledo, O. (Sectional and flexible)
Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
Plant Rubber & Asbestos Works, San Francisco, Cal.
●Porter & Co., Inc., H. W., Newark, N. J. (Underground)
●Ric-wiL Co., Cleveland, O. (Underground)
Ruberoid Co., New York, N. Y. (Asbestos, magnesia)
Sall Mountain Co., Chicago, Ill. (Asbestos)
Schundler & Co., Inc., F. E., Long Island City, N. Y.
Smith & Kanzler, Inc., Elizabeth, N. J. (Asbestos air cell, wool felt and hair felt)
Standard Asbestos Mfg. Co., Chicago, Ill.
Standard Lime & Stone Co., Baltimore, Md. (Rockwool)
Union Asbestos & Rubber Co., Cicero, Ill.
United Cork Companies, Lyndhurst, N. J.
Walker Jamar Co., Duluth, Minn.
●Wilson, Inc., Grant, Chicago, Ill.
Wyckoff & Son Co., A., Elmira, N. Y. (Wood)

IONIZATION APPARATUS

American Hydrozone Co., Inc., New York, N. Y.
Corozone Air Conditioning Corp., Cleveland, O.
Electroaire Corp., Chicago, Ill.
Lowell Air Conditioning Corp., Philadelphia, Pa.
Montgomery Bros., San Francisco, Cal.
Norwood Filtration Co., The, Florence, Mass.
Ozo-Ray Process Corp., Chicago, Ill.
United States Ozone Co. of America, Scottdale, Pa.

IRON BODY VALVES

See Valves, Gate; and Valves, Globe

JACKETED PIPE

See Pipe and Fittings, Jacketed

JOINTS, FLEXIBLE SWING

Barco Mfg. Co., Chicago, Ill.
Bordo Co., Inc., L. J., Glenside, Pa.
Patterson-Ballagh Corp., Los Angeles, Cal.

JOINTS, PIPE, ELECTRICAL INSULATING

Barco Mfg. Co., Chicago, Ill.

JOINTS, PIPE, EXPANSION, PACKLESS

●American District Steam Co., North Tonawanda, N. Y.
Badger Fire Extinguisher Co., Boston, Mass.
Badger & Sons Co., E. B., Boston, Mass. (Corrugated copper, stainless steel)
Barco Mfg. Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Foster Wheeler Corp., New York, N. Y.
Fulton Sylphon Co., Knoxville, Tenn.
Griscom-Russell Co., The, New York, N. Y.
Harris & Co., Arthur, Chicago, Ill.
Kopperman & Sons, Joseph, Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Semet-Solvay Engineering Corp., New York, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
United States Rubber Co., New York, N. Y.
Walworth Co., New York, N. Y.

JOINTS, PIPE, EXPANSION, SLIP

●American District Steam Co., North Tonawanda, N. Y.
Dresser Mfg. Co., Bradford, Pa.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Fulton Sylphon Co., Knoxville. Tenn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Howard Iron Works & Alberger Heater Co., Buffalo, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Semet-Solvay Engineering Corp., New York, N. Y.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
●Yarnall-Waring Co., Philadelphia, Pa.

KATA THERMOMETERS

See Thermometers, Kata

LACQUERS

See Enamels and Lacquers

LAMPS, STERILIZING, FOR DUCT INSTALLATION

General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

LEAD PIPE

See Pipe, Lead

LEAD SHEETS

See Sheets, Lead

LEAK DETECTORS

See Detectors, Leak, Refrigerant

LEATHER BELTING

See Belting, Flat, Leather

LEATHER PACKING

See Packing, Leather

LIQUID LEVEL GAGES

See Gages, Liquid Level

LIQUID LEVEL RECORDERS

See Recorders, Liquid Level

LIQUID PRESSURE REGULATORS

See Regulators, Pressure, Liquid

LOCK FORMING MACHINES

See Machines, Pittsburgh Lock Forming

LOCK NUTS

See Nuts, Lock

LOUVERS AND SHUTTERS, AUTOMATICALLY OR MANUALLY CONTROLLED

Air Conditioning Products Co., Detroit, Mich.
Air Control Products, Inc., Muskegon, Mich.
●Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
American Blower Corp., Detroit, Mich.
American Coolair Corp., Jacksonville, Fla.
American Foundry & Furnace Co., Bloomington, Ill.
American Warming & Ventilating Co., Toledo, O.
Ames Co., W. R., San Francisco, Cal.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Co., Chicago, Ill.
Barber-Colman Co., Rockford, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., St. Louis, Mo.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Burt Mfg. Co., Akron, O.
California Cornice, Steel & Supply Corp., Los Angeles, Cal.
Campbell Heating Co., E. K., Kansas City, Mo.
Champion Blower & Forge Co., Lancaster, Pa.
Chelsea Fan & Blower Co., New York, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Circulators & Devices Mfg. Corp., New York, N. Y.
Clay Equipment Corp., Cedar Falls, Ia.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Elgo Shutter & Mfg. Co., Detroit, Mich.
Falstrom Co., Passaic, N. J.
General Blower Co., Inc., Philadelphia, Pa.
General Regulator Corp., Chicago, Ill.
Gillian Mfg. Co., Detroit, Mich.
Hirschman Co., W. F., Buffalo, N. Y.
Hunter Fan & Ventilating Co., Inc., Memphis, Tenn.
●International Engineering, Inc., Dayton, O.
International Steel Co., Evansville, Ind.
Jamieson Mfg. Co., Dallas, Tex.
Johnson Fan & Blower Corp., Chicago, Ill.
Johnston Co., William W., Dayton, O.
Jordan & Co., Paul R., Indianapolis, Ind.
Kelvin-White Co., Boston, Mass.
King Ventilating Co., Owatonna, Minn.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kisco Co., Inc., St. Louis, Mo.
Leslie Welding Co., Chicago, Ill.
Lockjoint Wood Products Co., Wichita, Kans. (Wood; stationary door, wall, window and ceiling)
Lohman, Inc., Wm. J., New York, N. Y.
Martin Metal Mfg. Co., Wichita, Kan.
Meier Electric & Machine Co., Indianapolis, Ind.
Meyer Mfg. Co., Detroit, Mich.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mountain States Equipment Co., Denver Colo.
Myers Electric Co., Inc., Pittsburgh, Pa.
Peerless Electric Co., Warren, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Schoedinger, F. O., Columbus, O.
Signal Electric Mfg. Co., Menominee, Mich.
Snoair, Dallas, Tex.
Standard Stamping & Perforating Co., Chicago, Ill.
Supreme Heater & Ventilating Corp., St. Louis, Mo. (Oscillating)
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
●Waterloo Register Co., Waterloo, Ia.
Willis Mfg. Co., Inc., Galesburg, Ill.

LOW WATER CUT-OFFS

See Cut-Offs, Low Water, Heating Boiler

MACHINES, BLUE PRINT AND WHITE PRINT

For Reproducing Engineering Drawings

Bruning Co., Inc., Charles, Long Island City, N. Y.
Ozalid Products Div., General Aniline & Film Corp., Johnson City, N. Y.

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Paragon-Revolute Corp., Rochester, N. Y.
Pease Co., C. F., The, Chicago, Ill.
Peck & Co., W. J., Chicago, Ill.
Wickes Brothers, Saginaw, Mich.

MACHINES, CLEANING, AIR FILTER

Air Filter Engineering Co., Omaha, Neb.

MACHINES AND FILM, X-RAY

Eastman Kodak Co., Rochester, N. Y.
Kelly-Koet, Covington, Ky.
Westinghouse X-Ray Co., Inc., Long Island City, N. Y.

MACHINES, PIPE CUTTING AND THREADING, PORTABLE

Air Reduction Sales Co., New York, N. Y. (Cutting and beveling)
Beaver Pipe Tools, Inc., Warren, O.
Curtis & Curtis Co., Bridgeport, Conn.
Landis Machine Co., Inc., Waynesboro, Pa.
Linde Air Products Co., The, New York, N. Y. (Cutting and beveling)
National Machine Works, Chicago, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Peerless Mach. Co., Racine, Wis.
Ridge Tool Co., Elyria, O. (Hand)
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PIPE CUTTING AND THREADING, STATIONARY

Beaver Pipe Tools, Inc., Warren, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Bullard Co., The, Bridgeport, Conn. (Vertical, threading & boring)
Curtis & Curtis Co., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
Landis Machine Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo, O.
Oster Mfg. Co., Cleveland, O.
Saunders Sons, Inc., D., Yonkers, N. Y.
Toledo Pipe Threading Machine Co., Toledo, O.

MACHINES, PITTSBURGH LOCK FORMING

Binkley Mfg. Co., Warrenton, Mo.
Lockformer Co., Chicago, Ill.
Maplewood Machinery Co., Inc., Chicago, Ill.
Ward Machinery Co., Chicago, Ill.
Whitney Metal Tool Co., Rockford, Ill.

MACHINES, REFRIGERATION, ABSORPTION

●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Philadelphia & Reading Coal & Iron Co., Philadelphia, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
York Ice Machinery Corp., York, Pa.

MALLEABLE UNIONS

See Unions, Malleable

MANIFOLDS, REFRIGERATION

●Baker Ice Machine Co., Inc., Omaha, Neb.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Frick Co., Waynesboro, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Superior Valve and Fittings Co., Pittsburgh, Pa.
York Ice Machinery Corp., York, Pa.

MANOMETERS

American Meter Co., Inc., New York, N. Y.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

MECHANICAL DRIVE TURBINES

See Turbines, Mechanical Drive

MECHANICAL SPEED CHANGERS

See Changers, Speed, Mechanical

MECHANICAL TRAPS

See Traps, Steam, Mechanical

MERCURY SWITCHES

See Switches, Mercury

METAL HOSE

See Hose, Metal, for Eliminating Compressor Vibration

METALLIC PACKING

See Packing, Metallic

METERS, AIR VELOCITY, DIRECT READING

Detroit Air Meter Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, CONDENSATION

●American District Steam Co., North Tonawanda, N. Y.
Buffalo Meter Co., Buffalo, N. Y.
●Central Station Steam Co., Detroit, Mich.
Morehead Mfg. Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, FLOW, REFRIGERANT

Bristol Co., Waterbury, Conn.
Builders Iron Foundry, Providence, R. I.

METERS, FLOW, STEAM

●American District Steam Co., North Tonawanda, N. Y.
American Meter Co., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
●Cochrane Corp, Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.

METERS, PROCESS LIQUID

American Meter Co., Inc., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Buffalo Meter Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
●Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Meriam Co., The, Cleveland, O.
Morey & Jones, Ltd., Los Angeles, Cal.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Schutte & Koerting Co., Philadelphia, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Worthington-Gamon Meter Co., Harrison, N. J.

METERS, WATER

Bailey Meter Co., Cleveland, O.
Buffalo Meter Co., Buffalo, N. Y.
Builders Iron Foundry, Providence, R. I.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Morey & Jones, Ltd., Los Angeles, Cal.
National Meter Co., Brooklyn, N. Y.
Neptune Meter Co., New York, N. Y.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Republic Flow Meters Co., Chicago, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.
Union Water Meter Co., Worcester, Mass.
Worthington-Gamon Meter Co., Harrison, N. J.

MIXING VALVES

See Valves, Mixing, Steam and Water

MODULATING VALVES

See Valves, Radiator, Steam and Hot Water

MOTOR BASES

See Bases and Pads, Vibration Isolating; Bases, Motor, Tension Adjusting

MOTOR CONTROLLERS

See Controllers and Starters, Motor

MOTOR OPERATED VALVES

See Valves, Motor Operated

MOTOR STARTERS

See Controllers and Starters, Motor

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MOTORS, ELECTRIC, FRACTIONAL HP
Baldor Electric Co., St. Louis, Mo.
Barber-Colman Co., Rockford, Ill.
Bodine Electric Co., Chicago, Ill.
Brown-Brockmeyer Co., Dayton, O.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Delco Appliance Co., Rochester, N. Y.
Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Electric Co., Boston, Mass.
●Howell Electric Motors Co., Howell, Mich.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Master Electric Co., Dayton, O.
Ohio Electric Mfg. Co., Cleveland, O.
Peerless Electric Co., Warren, O.
Reynolds Electric Co., Chicago, Ill.
Robbins & Myers, Inc., Springfield, O.
Speedway Mfg. Co., Chicago (Cicero), Ill.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
Victor Electric Products, Inc., Cincinnati, O.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS, ELECTRIC, 1 HP AND OVER
Allis Co., Louis, The, Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Baldor Electric Co., St. Louis, Mo.
Bogue Electric Co., Paterson, N. J.
Brown-Brockmeyer Co., Dayton, O.
Burke Electric Co., Erie, Pa.
Canatsey Electric Mfg. Co., Kansas City, Mo.
●Century Electric Co., St. Louis, Mo.
Continental Electric Co., Inc., Newark, N. J.
Crocker-Wheeler Elec. Mfg. Co., Ampere, N. J.
Delco Products Corp., Dayton, O.
Diehl Mfg. Co., Elizabethport, N. J.
Electric Machinery Mfg. Co., Minneapolis, Minn.
Emerson Electric Mfg. Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.
Holtzer-Cabot Electric Co., Boston, Mass. (2 & less)
●Howell Electric Motors Co., Howell, Mich.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Janette Mfg. Co., Chicago, Ill.
Leland Electric Co., Dayton, O.
Lincoln Electric Co., Cleveland, O.
Marathon Electric Mfg. Corp., Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Master Electric Co., Dayton, O.
Peerless Electric Co., Warren, O.
Philadelphia Gear Co., Philadelphia, Pa. (Geared)
Reliance Electric & Engineering Co., Cleveland, O.
Robbins & Myers, Inc., Springfield, O.
Star Electric Motor Co., Bloomfield, N. J.
Sterling Electric Motors, Inc., Los Angeles, Cal.
Sturtevant Co., B. F., Boston, Mass.
U. S. Electrical Motors, Inc., Los Angeles, Cal.
●Wagner Electric Corp., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Zobell Electric Motor Corp., Garwood, N .J.

MUSHROOM VENTILATORS
See Ventilators, Mushroom

NEEDLE VALVES
See Valves, Needle

NEUTRALIZERS, ACID
See Dehydrant and Acid Neutralizer

NIPPLES, PIPE, BRASS AND COPPER
Acheson Mfg. Co., Rankin, Pa.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Limbert & Co., Geo. B., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rockford Brass Works, Rockford, Ill.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
Weatherhead Co., Cleveland, O.

NIPPLES, PIPE, IRON AND STEEL
Alabama Pipe Co., Anniston, Ala. (Cast iron)
Alloy Steel Products Co., Linden, N. J. (Stainless steel)
●Byers Co., A. M., Pittsburgh, Pa. (Wrought iron)
Chicago Nipple Mfg. Co., Chicago, Ill.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Dresser Mfg. Co., Bradford, Pa.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Limbert & Co., Geo. B., Chicago, Ill.
Penn Mfg. Corp. of Washington, Pa., Washington, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.

NOISE ELIMINATORS
See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration; Insulation, Sound Deadening

NOZZLES, SPRAY
Balloffet Dies and Nozzle Co., Inc., Guttenberg, N. J.
Bayley Blower Co., Milwaukee, Wis.
Benjamin Air Rifle Co., St. Louis, Mo.
Betz Air Conditioning Corp., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Blower Application Co., Milwaukee, Wis.
●Buffalo Forge Co., Buffalo, N. Y.
Chain Belt Co., Milwaukee, Wis.
●Clarage Fan Co., Kalamazoo, Mich.
DeVilbiss Co., The, Toledo, O.
Dustlix Corp., Milwaukee, Wis.
Fluor Corp., Ltd., The, Los Angeles, Cal.
International Moistening Co., Providence, R. I.
Link-Belt Co., Chicago, Ill.
●Marley Co., Kansas City, Mo.
Martocello & Co., Jos. A., Philadelphia, Pa.
Milburn Co., Alexander, Baltimore, Md.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Peterson Freezem Mfg. & Sales Co., Kansas City, Mo.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Plummer Spray Equipment Co., Napoleon, O.
Rega Mfg. Co., Rochester, N. Y.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., Affton Station, St. Louis, Mo.
Schutte & Koerting Co., Philadelphia, Pa.
Skinner Irrigation Co., Troy, O.
Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
●Spraying Systems Co., Chicago, Ill.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Boston, Mass.
Supreme Electric Products Corp., Rochester, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

NUTS, LOCK
Elastic Stop Nut Corp., Union, N. J.
Fafnir Bearing Co., New Britain, Conn.
●Grinnell Co., Inc., Providence, R. I.
Industrial Lock Nut Co., South Hanover, Mass.
Kwikon Co., Chicago, Ill.
Locknut Corp. of America, Chicago, Ill.
MacLean-Fogg Lock Nut Co., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn.
Palnut Co., Irvington, N. J.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Walworth Co., New York, N. Y.

OBSERVATION PORTS, BOILER
Detroit Stoker Co., Detroit, Mich.

ODOR ADSORBERS
See Filters, Air; Adsorbers, Odor

ODOR NEUTRALIZERS
See Adsorbers, Odor

OIL BURNERS
See Burners, Oil

OIL SEPARATORS
See Separators, Steam and Oil

OPEN END WRENCHES
See Wrenches, Open End

● Advertisement in this issue. See Index to Advertisers, page 282.

OPERATORS, DAMPER, DUCT

- Au-Temp-Co Corp., New York, N. Y.
- ●Automatic Products Co., Milwaukee, Wis.
- Automatic Temperature Control Co., Inc., Philadelphia, Pa.
- Barber-Colman Co., Rockford, Ill.
- ●Detroit Lubricator Co., Detroit, Mich.
- Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
- Fulton Sylphon Co., Knoxville, Tenn.
- ●General Controls Co., Glendale, Cal.
- Herske & Timmis, Inc., New York, N. Y.
- ●Johnson Service Co., Milwaukee, Wis.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- Powers Regulator Co., Chicago, Ill.
- ●Taylor Instrument Companies, Rochester, N. Y.
- Young Regulator Co., Cleveland, O.

OPERATORS, VALVE

- Au-Temp-Co Corp., New York, N. Y.
- Automatic Temperature Control Co., Inc., Philadelphia, Pa.
- Barber-Colman Co., Rockford, Ill.
- Barnes Co., W. F. & John, Rockford, Ill.
- Bristol Co., Waterbury, Conn.
- Brooke Engineering Co., Inc., Philadelphia, Pa.
- Cooper Co., Clark, Philadelphia, Pa.
- ●Crane Co., Chicago, Ill.
- Cutler-Hammer, Inc., Milwaukee, Wis.
- ●Detroit Lubricator Co., Detroit, Mich.
- Fulton Sylphon Co., Knoxville, Tenn.
- ●General Controls Co., Glendale, Cal.
- Herske & Timmis, Inc., New York, N. Y.
- ●Johnson Service Co., Milwaukee, Wis.
- Mason-Neilan Regulator Co., Boston, Mass.
- ●McDonnell & Miller, Chicago, Ill.
- ●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
- Perfex Corp. (Controls Div.), Milwaukee, Wis.
- Powers Regulator Co., Chicago, Ill.
- Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
- ●Taylor Instrument Companies, Rochester, N. Y.

ORIFICES, RADIATOR

- Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
- ●Bell & Gossett Co., Chicago, Ill.
- ●Dunham Co., C. A., Chicago, Ill.
- Haines & Co., William S., Philadelphia, Pa.
- Herske & Timmis, Inc., New York, N. Y.
- ●Hoffman Specialty Co., Inc., Waterbury, Conn.
- ●Illinois Engineering Co., Chicago, Ill.
- Milwaukee Valve Co., Milwaukee, Wis.
- New York Air Valve Corp., New York, N. Y.
- ●Sarco Co., Inc., New York, N. Y.
- ●Spence Engineering Co., Inc., Walden, N. Y.
- Sterling, Inc., Milwaukee, Wis.
- Tallmadge & Co., Webster, East Orange, N. J.
- Thrush & Co., H. A., Peru, Ind.
- ●Trane Co., La Crosse, Wis.
- Walker and Eder, Inc., New York, N. Y.
- ●Webster & Co., Warren, Camden, N. J.
- Webster Tallmadge & Co., East Orange, N. J.

OXY-ACETYLENE WELDING

See Welding and Cutting Apparatus, Oxy-Acetylene

OZONE APPARATUS

- American Hydrozone Co., Inc., New York, N. Y.
- Automatic Pump & Softener Corp., Rockford, Ill.
- Chelsea Fan & Blower Co., New York, N. Y.
- Corozone Air Conditioning Corp., Cleveland, O.
- Electroaire Corp., Chicago, Ill.
- Kisco Co., Inc., St. Louis, Mo.
- Lohman, Inc., Wm. J., New York, N. Y.
- Montgomery Bros., San Francisco, Cal.
- Norwood Filtration Co., The, Florence, Mass.
- Ozone Air Co., Grand Rapids, Mich.
- Ozo-Ray Process Corp., Chicago, Ill.
- Sealkote Corp., Chicago, Ill.
- United States Ozone Co. of America, Scottdale, Pa.

PACKING, ASBESTOS

- Acme Asbestos Coverings & Flooring Co., Chicago, Ill.
- Allpax Co., Inc., Mamaroneck, N. Y.
- Anchor Packing Co., Philadelphia, Pa.
- Austin-Mason Co., New York, N. Y.
- Belmont Packing & Rubber Co., Philadelphia, Pa.
- ●Carey Co., Philip, Lockland, Cincinnati, O.
- Chicago Specialty Mfg. Co., Chicago, Ill.
- Crane Packing Co., Chicago, Ill.
- Darcoid Co., Inc., New York, N. Y.
- Durabla Mfg. Co., New York, N. Y.
- ●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- Felt Products Mfg. Co., Chicago, Ill.
- Garlock Packing Co., Palmyra, N. Y.
- Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
- Greene, Tweed & Co., New York, N. Y.
- ●Jenkins Bros., New York, N. Y.
- Johns-Manville, New York, N. Y.
- Keasbey Co., Robert A., New York, N. Y.
- Keasbey & Mattison Co., Ambler, Pa.
- Klingerit, Inc., New York, N. Y. (Sheet & rod)
- Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
- Metallo Gasket Co., New Brunswick, N. J.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Quaker Rubber Corp., Philadelphia, Pa.
- Sall Mountain Co., Chicago, Ill.
- Union Asbestos & Rubber Co., Cicero, Ill.
- United States Rubber Co., New York, N. Y.

PACKING, FIBER

- Anchor Packing Co., Philadelphia, Pa.
- Austin-Mason Co., New York, N. Y.
- Belmont Packing & Rubber Co., Philadelphia, Pa.
- Darcoid Co., Inc., New York, N. Y.
- Durabla Mfg. Co., New York, N. Y.
- ●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- Endura Mfg. Corp., Quakertown, Pa.
- Garlock Packing Co., Palmyra, N. Y.
- Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
- ●Jenkins Bros., New York, N. Y.
- Johns-Manville, New York, N. Y.
- Keasbey Co., Robert A., New York, N. Y.
- Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
- McQuay-Norris Mfg. Co., St. Louis, Mo.
- Metallo Gasket Co., New Brunswick, N. J.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Paxtix, Inc., Chicago, Ill.
- Quaker Rubber Corp., Philadelphia, Pa.
- Union Asbestos & Rubber Co., Cicero, Ill.
- United States Rubber Co., New York, N. Y.

PACKING, LEATHER

- Alexander Bros., Philadelphia, Pa.
- Belmont Packing & Rubber Co., Philadelphia, Pa.
- Chicago Belting Co., Chicago, Ill.
- Excelsior Leather Washer Co., Rockford, Ill.
- Graton & Knight Co., Worcester, Mass.
- Houghton & Co., E. F., Philadelphia, Pa.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- ●Rhoads & Sons, J. E., Philadelphia, Pa.
- Williams & Son, I. B., Dover, N. H.

PACKING, METALLIC

- Aeco Packing Products Co., Chicago, Ill.
- Allpax Co., Inc., Mamaroneck, N. Y.
- Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
- Anchor Packing Co., Philadelphia, Pa.
- Austin-Mason Co., New York, N. Y.
- Belmont Packing & Rubber Co., Philadelphia, Pa.
- Conneaut Packing Co., Conneaut, O.
- Crane Packing Co., Chicago, Ill.
- Darcoid Co., Inc., New York, N. Y.
- Felt Products Mfg. Co., Chicago, Ill.
- France Packing Co., Tacony, Philadelphia, Pa.
- Garlock Packing Co., Palmyra, N. Y.
- Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.
- Hound Packing Co., Chicago, Ill.
- Johns-Manville, New York, N. Y.
- Klingerit, Inc., New York, N. Y. (Sheet & rod)
- Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
- McQuay-Norris Mfg. Co., St. Louis, Mo.
- National Engineering Products, Inc., Washington, D. C.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Rotary Seal Co., Chicago, Ill.
- Union Asbestos & Rubber Co., Cicero, Ill.
- United States Rubber Co., New York, N. Y.

PACKING, RUBBER

- Anchor Packing Co., Philadelphia, Pa.
- Austin-Mason Co., New York, N. Y.
- Belmont Packing & Rubber Co., Philadelphia, Pa.
- Boston Woven Hose & Rubber Co., Cambridge, Mass.
- Chicago Specialty Mfg. Co., Chicago, Ill.
- Continental Rubber Wks., Erie, Pa.
- Crane Packing Co., Chicago, Ill.
- Darcoid Co., Inc., New York, N. Y.
- ●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
- Garlock Packing Co., Palmyra, N. Y.
- Gates Rubber Co., Denver, Colo.
- Goodrich Co., B. F., Akron, O.
- Goodyear Tire & Rubber Co., Akron, O.
- Hamilton Rubber Mfg. Co., Trenton, N. J.
- ●Jenkins Bros., New York, N. Y.
- Johns-Manville, New York, N. Y.
- Linear Packing & Rubber Co., Inc., Philadelphia, Pa.
- Manhattan Rubber Mfg. Co., Div. of Raybestos-Manhattan Inc., Passaic, N. J.
- Miller Rubber Co., Inc., Akron, O.
- Pacific States Felt & Mfg. Co., Inc., San Francisco, Cal.
- Quaker Rubber Corp., Philadelphia, Pa.
- Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
- Resistoflex Corp., Belleville, N. J. (Synthetic resin)
- Union Asbestos & Rubber Co., Cicero, Ill.
- United States Rubber Co., New York, N. Y.

PARTS FOR HEATING AND AIR CONDITIONING EQUIPMENT

- ●Commercial Shearing & Stamping Co., Youngstown, O. (Tank heads and bottoms, water heater legs, furnace stampings, etc.)

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Dry-Zero Corp., Chicago, Ill. (Cabinet construction for air conditioning and warm air heating equipment)
Geuder, Paeschke & Frey Co., Milwaukee, Wis.

PILLOW BLOCK BEARINGS

See Bearings, Pillow Block

PIPE, ASBESTOS FIBER AND CEMENT

Johns-Manville, New York, N. Y.
Keasbey & Mattison Co., Ambler, Pa.
Union Asbestos & Rubber Co., Cicero, Ill.

PIPE BENDERS

See Benders, Pipe

PIPE, BRASS AND COPPER

American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Foster Wheeler Corp., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., New York, N. Y.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

PIPE, CAST IRON, PRESSURE, BELL AND SPIGOT

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
National Machine Wks., Chicago, Ill.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, PRESSURE, FLANGED

Alabama Pipe Co., Anniston, Ala.
American Cast Iron Pipe Co., Birmingham, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
Duriron Co., Inc., Dayton, O. (Acid resisting)
Inner-Tite Clamp Corp., Elizabeth, N. J.
Lynchburg Foundry Co., Lynchburg, Va.
McWane Cast Iron Pipe Co., Birmingham, Ala.
National Machine Wks., Chicago, Ill.
U. S. Pipe & Fdry. Co., Burlington, N. J.
Walworth Co., New York, N. Y.
Warren Foundry & Pipe Corp., New York, N. Y.

PIPE, CAST IRON, THREADED

Alabama Pipe Co., Anniston, Ala.
Central Foundry Co., New York, N. Y.
Clow & Sons, James B., Chicago, Ill.
McWane Cast Iron Pipe Co., Birmingham, Ala.
Somerville Iron Wks., Somerville, N. J.
U. S. Pipe & Foundry Co., Burlington, N. J.
Walworth Co., New York, N. Y.

PIPE CLEANING COMPOUNDS

See Compounds, Cleaning, Pipe Coil and Condenser

PIPE COILS

See Coils, Pipe

PIPE COUPLINGS

See Couplings, Pipe

PIPE CUTTERS

See Cutters

PIPE CUTTING MACHINES

See Machines, Pipe Cutting and Threading

PIPE EXTRACTORS

See Extractors, Pipe

PIPE FITTINGS

See Fittings, Pipe

PIPE AND FITTINGS, HARD RUBBER

American Hard Rubber Co., New York, N. Y.
Goodrich Co., B. F., Akron, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Stokes Rubber Co., Jos., Trenton, N. J.
United States Rubber Co., New York, N. Y.

PIPE AND FITTINGS, JACKETED

Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Parks-Cramer Co., Fitchburg, Mass.

PIPE AND FITTINGS, STONEWARE

Continental Diamond Fibre Co., Newark, Del. (Molded plastic)
General Ceramics Co., New York, N. Y.
Knight, Maurice A., Akron, O. (Stoneware)
U. S. Stoneware Co., New York, N. Y. (Stoneware)

PIPE FLANGES

See Flanges, Pipe

PIPE, GLASS

Corning Glass Wks., Corning, N. Y.

PIPE HANGERS

See Hangers and Supports, Pipe

PIPE JOINT COMPOUNDS

See Cement and Compounds, Pipe Joint

PIPE INSULATION

See Insulation, Pipe

PIPE, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.

PIPE, LINED

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Brass Co., Waterbury, Conn. (Tin)
American Cast Iron Pipe Co., Birmingham, Ala. (Cement)
American Hard Rubber Co., New York, N. Y. (Rubber)
Cohoes Rolling Mill Co., Cohoes, N. Y. (Cement)
General Plate Div., Metals & Controls Corp., Attleboro, Mass. (Silver lined)
Goodrich Co., B. F., Akron, O. (Rubber-lined)
Jones & Laughlin Steel Corp., Pittsburgh, Pa. (Cement)
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead and tin lined)
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Manhattan Rubber Mfg. Co. Div. of Raybestos-Manhattan, Inc., Passaic, N. J. (Rubber)
National Lead Co., New York, N. Y. (Lead)
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa. (Cement)
Public Works Supply Co., Lynn, Mass. (Cement)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
United States Rubber Co., New York, N. Y. (Rubber)
Vitreous Enameling & Stamping Co., New York, N. Y. (Enamel)
Warren Foundry & Pipe Corp., New York, N. Y. (Cement-bituminous enamel)
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE LINE STRAINERS

See Strainers, Pipe Line

PIPE NIPPLES

See Nipples, Pipe

PIPE REAMERS

See Reamers, Pipe

PIPE REPAIR CLAMPS

See Clamps, Pipe Repair

PIPE, SPIRAL, RIVETED AND WELDED

●American Rolling Mill Co., The, Middletown, O.
Naylor Pipe Co., Chicago, Ill.
●Taylor Forge & Pipe Wks., Chicago, Ill.

PIPE, STEEL, BUTT AND LAP WELDED

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Locomotive Co., Alco Products Div., New York, N. Y.
●American Rolling Mill Co., The, Middletown, O.
Bethlehem Steel Co., Bethlehem, Pa.
●Byers Co., A. M., Pittsburgh, Pa.
Chicago Bridge & Iron Co., Chicago, Ill. (Specially fabricated)
Cohoes Rolling Mill Co., Cohoes, N. Y.
Fretz-Moon Tube Co., Butler, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Tube Co., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.
Semet-Solvay Engineering Corp., New York, N. Y. (Specially fabricated)
South Chester Tube Co., Chester, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
●Taylor Forge & Pipe Wks., Chicago, Ill.
Wheatland Tube Co., Philadelphia, Pa.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

PIPE, STEEL, SEAMLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
●Youngstown Sheet & Tube Co., Youngstown, O.

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PIPE, STEEL, STAINLESS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
●American Rolling Mill Co., The, Middletown, O.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
●Republic Steel Corp., Cleveland, O.

PIPE SUPPORTS
See Hangers and Supports, Pipe

PIPE TONGS
See Tongs, Pipe

PIPE, TUBING, FITTINGS AND VALVES, CARBON
National Carbon Co., Carbon Sales Div., Cleveland, O.

PIPE VISES
See Vises, Pipe

PIPE, WOOD
●American District Steam Co., North Tonawanda, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Michigan Pipe Co., Bay City, Mich.
Wyckoff & Son Co., A., Elmira, N. Y.

PIPE WRENCHES
See Wrenches, Pipe

PIPE, WROUGHT IRON
●Byers Co., A. M., Pittsburgh, Pa.
Cohoes Rolling Mill Co., Cohoes, N. Y.
South Chester Tube Co., Chester, Pa.

PISTON RINGS
See Rings, Piston

PITOT TUBES
See Tubes, Pitot

PITTSBURGH LOCK FORMING MACHINES
See Machines, Pittsburgh Lock Forming

PLATES, FLOOR AND CEILING
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Chicago Nipple Mfg. Co., Chicago, Ill.
Farley Sleeve & Hanger Co., Cleveland, O.
Fee & Mason Mfg. Co., Inc., New York, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Grabler Mfg. Co., Cleveland, O.
●Grinnell Co., Inc., Providence, R. I.
Jarecki Mfg. Co., Erie, Pa.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Ravena Iron Co., Ravena, N. Y.
Russell Mfg. Co., John M., Naugatuck, Conn.

PLUG COCKS
See Valves, Plug

PLUG VALVES
See Valves, Plug

POWER SHEARS
See Shears, Power

PREHEATERS, FUEL OIL
●American District Steam Co., North Tonawanda, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
●Bell & Gossett Co., Chicago, Ill.
Davis Engineering Corp., Elizabeth, N. J.
Engineer Co., New York, N. Y.
Frank Heaters, Inc., Paterson, N. J.
General Fittings Co., Providence, R. I.
Griscom-Russell Co., New York, N. Y.
Hynes Electric Heating Co., Philadelphia, Pa.
Johnson Corp., Three Rivers, Mich.
National Pipe Bending Co., New Haven, Conn.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Purdue Associates, Albert G., New Haven, Conn.
Richmond Engineering Co., Inc., Richmond, Va.
Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Semet-Solvay Engineering Corp., New York, N. Y.
Sims Co., Erie, Pa.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Taco Heaters, Inc., New York, N. Y.
Trent Co., Harold E., Philadelphia, Pa.
Viscostat Co., Chicago, Ill.
Vulcan Electric Co., Lynn, Mass.
Warren Electric Appliance Co., Warren, Pa.
●Whitlock Mfg. Co., Hartford, Conn.
●Wiegand Co., Edwin L., Pittsburgh, Pa.

PREHEATERS AND STRESS RELIEVERS, ELECTRIC, FOR PIPE WELDS
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Swoboda, Inc., H. O., New Brighton, Pa.
Trent Co., Harold E., Philadelphia, Pa.

PRESSURE BLOWERS
See Blowers, High Pressure

PRESSURE CONTROLLERS
See Regulators, Pressure

PRESSURE GAGES
See Gages, Indicating, Pressure

PRESSURE INDICATOR-CONTROLLERS
See Indicator-Controllers, Pressure

PRESSURE RECORDER-CONTOLLERS
See Recorder-Controllers, Pressure

PRESSURE RECORDERS
See Recorders, Pressure and Vacuum

PRESSURE REDUCING VALVES
See Valves, Pressure Reducing and Regulating

PRESSURE REGULATING VALVES
See Valves, Pressure Reducing and Regulating

PRESSURE REGULATORS
See Regulators, Pressure

PRESSURE SWITCHES
See Switches, Pressure and Vacuum

PROCESS HEATING SYSTEMS
See Systems, Process Heating, High Temperature

PROCESS STEAM SUPERHEATERS
See Superheaters, Process Steam

PROCESS AND STORAGE TANKS
See Tanks, Process and Storage

PROPELLER FANS
See Fans, Propeller

PROPORTIONING PUMPS
See Pumps, Proportioning

PROTECTORS, PIPE COVERING
●American District Steam Co., North Tonawanda, N. Y.
Carpenter & Paterson, Inc., East Boston, Mass.
Cheney Co., Philadelphia, Pa.
●Grinnell Co., Inc., Providence, R. I.
●Ric-wiL Co., Cleveland, O.

PSYCHROMETERS, SLING AND HAND ASPIRATED
American Moistening Co., Providence, R. I.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Parks-Cramer Co., Fitchburg, Mass.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Weksler Thermometer Corp., New York, N. Y.

PSYCHROSTATS
See Humidistats

PULLEYS AND SHEAVES, FOR BELT DRIVES
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Pulley Co., Philadelphia, Pa.
Browning Mfg. Co., Inc., Maysville, Ky.
Congress Die Casting Div., Congress Tool & Die Co., Detroit, Mich.
Dayton Rubber Mfg. Co., Dayton, O.
Dick Co., Inc., R. & J., Passaic, N. J.
Goldens' Foundry & Machine Co., Columbus, Ga.
Link-Belt Co., Chicago, Ill.
Morrison Products, Inc., Cleveland, O.
Rockwood Mfg. Co., Indianapolis, Ind.
Speedmaster Co., The, Des Plaines, Ill.
Utility Fan Corp., Los Angeles, Cal.
Wood's Sons Co., T. B., Chambersburg, Pa.

PUMP BASES
See Bases and Pads, Vibration Isolating

PUMPS, BOILER FEED
Acker Organization, Inc., W. M., Cleveland, O.
Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.

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Berns Specialty Co., Chicago, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Johnson Corp., Three Rivers, Mich.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Kraissl Co., Inc., The, Hackensack, N. J.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Morris Machine Works, Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Robbins & Myers, Inc., Springfield, O.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CENTRIFUGAL

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Beach-Russ Co., New York, N. Y.
Berns Specialty Co., Chicago, Ill.
Blaisdell Compressor Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chain Belt Co., Milwaukee, Wis.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kraissl Co., Inc., The, Hackensack, N. J.
La Bour Pump Co., Inc., Elkhart, Ind.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.

Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Palmer Electric Co., Detroit, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schneible Co., Claude B., Chicago, Ill.
Schwitzer-Cummins Co., Indianapolis, Ind.
Skidmore Corp., St. Joseph, Mich.
Smith Meter Co., Los Angeles, Cal.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
●Trane Co., La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
United Motors Service Co., Detroit, Mich.
Utility Fan Corp., Los Angeles, Cal.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Mfg. Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, CONDENSATION RETURN

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Hydrovac Corp., Brooklyn, N. Y.
Aurora Pump Co., Aurora, Ill.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Byron Jackson Co., Los Angeles, Cal.
Chicago Pump Co., Chicago, Ill.
Cissell Mfg. Co., W. M., Louisville, Ky.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
●Dean Bros. Co., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Decatur Pump Co., Decatur, Ill.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Eclipse Fuel Engineering Co., Rockford, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Heating Assurance, Inc., Spokane, Wash.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Ingersoll-Rand, New York, N. Y.
Jackson Co., Byron, Los Angeles, Cal.
Johnson Corp., Three Rivers, Mich.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Lecourtenay Co., Newark, N. J.
Lewis & Co., Inc., Chas. S., St. Louis, Mo.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Micro-Westco, Inc., Bettendorf, Ia.
Morehead Mfg. Co., Detroit, Mich.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
National Steam Pump Co., Upper Sandusky, O.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Skidmore Corp., St. Joseph, Mo.
Sterling, Inc., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling Pump Corp., Hamilton, O.
Swaby Mfg. Co., Chicago, Ill.
●Trane Co., La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, DEEP WELL, TURBINE

American-Marsh Pumps, Inc., Battle Creek, Mich.
American Well Wks., Aurora, Ill.
Aurora Pump Co., Aurora, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Cook, Inc., A. D., Lawrenceburg, Ind.
Davidson Co., M. T., New York, N. Y.
Deming Co., Salem, O.
Duro Co., Dayton, O.

● Advertisement in this issue. See Index to Advertisers, page 282.

Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
●Layne & Bowler, Inc., Memphis, Tenn.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia. (Jet type)
Peerless Pump Div., Food Machinery Corp., Canton, O.
Pomona Pump Co., Pomona, Cal.
Red Jacket Mfg. Co., Davenport, Ia.
Roper Corp., Geo. D., Rockford, Ill. (Plunger type)
Rumsey Pump Corp., Seneca Falls, N. Y.
Uniflow Mfg. Co., Erie, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, FIRE

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Dayton-Dowd Co., Quincy, Ill.
Economy Pumps, Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Lecourtenay Co., Newark, N. J.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Rumsey Pump Corp., Seneca Falls, N. Y.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, PROPORTIONING

●Cochrane Corp., Philadelphia, Pa.
Dearborn Chemical Co., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.
Nelson Chemical Pumps, Casper, Wyo.

PUMPS, RECIPROCATING

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alten's Foundry & Machine Works, Lancaster, O.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Deming Co., Salem, O.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pumps Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Red Jacket Mfg. Co., Davenport, Ia.
Rumsey Pump Corp., Seneca Falls, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, ROTARY

American Hard Rubber Co., New York, N. Y. (Hard Rubber)
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Davidson Co., M. T., New York, N. Y.
De Laval Steam Turbine Co.. Trenton, N. J.
Deming Co., Salem, O.
Eastern Engineering Co., New Haven, Conn.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Gould Pumps, Inc., Seneca Falls, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lammert & Mann Co., Chicago, Ill.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Logan Engineering Co., Chicago, Ill. (Radial diaphragm)
Martocello & Co., Jos. A., Philadelphia, Pa.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Robbins & Myers, Inc., Springfield, O.
Roots-Connersville Blower Corp., Connersville, Ind.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sundstrand Machine Tool Co., Rockford, Ill.
Taber Pump Co., Buffalo, N. Y.
Trimount Rotary Power Co., East Dedham, Mass.
Tuthill Pump Co., Chicago, Ill.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, STEAM

Alten's Foundry & Machine Works, Lancaster, O.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
National Steam Pump Co., Upper Sandusky, O.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.

PUMPS, SUMP

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Aurora Pump Co., Aurora, Ill.
Austin-Mason Co., New York, N. Y.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pneumatic Tool Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
Dayton-Dowd Co., Quincy, Ill.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., Salem, O.
Domestic Engine & Pump Co., Shippensburg, Pa.
Eastern Engineering Co., New Haven, Conn.
Economy Pumps, Inc., Chicago, Ill.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Wks., Inc., Brooklyn, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Micro-Westco, Inc., Bettendorf, Ia.
Morris Machine Wks., Baldwinsville, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
●Nash Engineering Co., South Norwalk, Conn.
Oberdorfer Brass Co., M. L., Syracuse, N. Y.
Penberthy Injector Co., Detroit, Mich.
Pomona Pump Co., Pomona, Cal.
Quimby Pump Co., Inc., Newark, N. J.
Red Jacket Mfg. Co., Davenport, Ia.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schneible Co., Claude B., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Swaby Mfg. Co., Chicago, Ill.
Taber Pump Co., Buffalo, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Union Steam Pump Co., Battle Creek, Mich.
Weil Pump Co., Chicago, Ill.
Weinman Pump Co., Columbus, O.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros Co., Chicago, Ill.

PUMPS, VACUUM HEATING

American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Hydrovac Corp., Brooklyn, N. Y.
Beach-Russ Co., New York, N. Y.
Chicago Pump Co., Chicago, Ill.
Croll-Reynolds Engineering Co., Inc., New York, N. Y.
Domestic Engine & Pump Co., Shippensburg, Pa.
●Dunham Co., C. A., Chicago, Ill.
Economy Pumps, Inc., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Guild & Garrison, Inc., Brooklyn, N. Y.
Gylstrom Co., O., Milwaukee, Wis.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Ingersoll-Rand, New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.

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●Nash Engineering Co., South Norwalk, Conn.
Skidmore Corp., St. Joseph, Mich.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Sterling, Inc., Milwaukee, Wis.
Sterling Pump Corp., Hamilton, O.
Union Steam Pump Co., Battle Creek, Mich.
Warren Steam Pump Co., Inc., Warren, Mass.
Weinman Pump Co., Columbus, O.
Whittington Pump & Engineering Co., Indianapolis, Ind.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUMPS, VISCOUS LIQUIDS AND HEAVY MATERIALS

Aldrich Pump Co., Allentown, Pa.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Austin-Mason Co., New York, N. Y.
Beach-Russ Co., New York, N. Y.
Blackmer Pump Co., Grand Rapids, Mich.
●Buffalo Pumps, Inc., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Columbus Steam Pump Wks. Co., Columbus, O.
Davidson Co., M. T., New York, N. Y.
●Dean Bros. Co., Indianapolis, Ind.
Economy Pumps, Inc., Chicago, Ill.
Engineer Co., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
Foster Pump Works, Inc., Brooklyn, N. Y.
Frederick Iron & Steel Co., Frederick, Md.
Gardner-Denver Co., Quincy, Ill.
Goulds Pumps, Inc., Seneca Falls, N. Y.
Guild & Garrison, Inc., Brooklyn, N. Y.
Ingersoll-Rand, New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., Los Angeles, Cal.
Kingsford Foundry & Machine Wks., Oswego, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Lawrence Pump & Engine Co., Lawrence, Mass.
Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, O.
Morris Machine Wks., Baldwinsville, N. Y.
Quimby Pump Co., Inc., Newark, N. J.
Robbins & Myers, Inc., Springfield, O.
Roper Corp., Geo. D., Rockford, Ill.
Rumsey Pump Corp., Seneca Falls, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Pump Corp., Hamilton, O.
Taber Pump Co., Buffalo, N. Y.
Tuthill Pump Co., Chicago, Ill.
Union Steam Pump Co., Battle Creek, Mich.
Viking Pump Co., Cedar Falls, Ia.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Yeomans Bros. Co., Chicago, Ill.

PUNCHES, SHEET METAL

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Callahan Can Machine Co., Inc., Brooklyn, N. Y.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Greenlee Mfg. Co., Rockford, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore Co., Beloit, Wis.
Henry & Wright Mfg. Co., Hartford, Conn.
International Nutyp Tool Co., Oswego, N. Y.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Perkins Machine Co., Warren, Mass.
Rock River Machine Co., Inc., Janesville, Wis.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Service Machine Co., Elizabeth, N. J.
Swaine Mfg. Co., Fred J., St. Louis, Mo.
Verson Allsteel Press Co., Chicago, Ill.
Whitney Mfg. Co., W. A., Rockford, Ill.
Whitney Metal Tool Co., Rockford, Ill.
Wiedemann Machine Co., Philadelphia, Pa.
●Williams & Co., J. H., New York, N. Y.
Zeh & Hahnemann Co., Newark, N. J.

PURGERS, REFRIGERANT GAS

●Armstrong Machine Works, Three Rivers, Mich.

RADIATION, CONVECTION TYPE, CAST IRON

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Crane Co., Chicago, Ill.
National Radiator Co., The, Johnstown, Pa.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
Smith Co., Inc., The, H. B. Westfield, Mass.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATION, CONVECTION TYPE, NON-FERROUS

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bush Mfg. Co., Hartford, Conn.
Commodore Heaters Corp., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
●G. & O. Mfg. Co., New Haven, Conn.
●Grinnell Co., Inc., Providence, R. I.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Rome-Turney Radiator Co., Rome, N. Y.
●Shaw-Perkins Mfg. Co., Pittsburgh, Pa.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., La Crosse, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vulcan Radiator Co., Hartford, Conn.
●Webster & Co., Warren, Camden, N. J.
●Young Radiator Co., Racine, Wis.

RADIATION, DIRECT

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
●Burnham Boiler Corp., Irvington, N. Y.
Clow & Sons, James B., Chicago, Ill. (Gas fired)
Columbia Radiator Co., McKeesport, Pa.
●Crane Co., Chicago, Ill.
Fowler & Wolf Radiator Co., Norristown, Pa.
Hart & Crouse Corp., Utica, N. Y.
International Heater Co., Utica, N. Y.
Kohler Co., Kohler, Wis.
Logansport Radiator Equipment Co., Logansport, Ind.
National Radiator Co., The, Johnstown, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Prox Co., Inc., Frank, Terre Haute, Ind.
Slater Mfg. Co., Wakefield, Mass. (Baseboard)
Smith Co., Inc., H. B., The, Westfield, Mass.
Thatcher Furnace Co., Newark, N. J.
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
Weil-McLain Co., Chicago, Ill.

RADIATOR AND CONVECTOR HUMIDIFIERS

See Humidifiers for Radiators and Convectors

RADIATOR HANGERS

See Hangers or Brackets, Radiator

RADIATOR ORIFICE VALVES

See Valves, Radiator, Orifice

RADIATOR ORIFICES

See Orifices, Radiator

RADIATOR VALVES

See Valves, Radiator

RADIATORS, HUMIDIFYING

●Burnham Boiler Corp., Irvington, N. Y.
Utica Radiator Corp., Utica, N. Y.

RADIATOR VENT VALVE HUMIDIFIERS

See Humidifiers, Radiator Vent Valve

RATCHET WRENCHES

See Wrenches, Ratchet

REAMERS, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Crown Die & Tool Co., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mueller Co., Decatur, Ill.
Nye Tool & Machine Wks., The, Chicago, Ill.
Toledo Pipe Threading Machine Co., Toledo, O.
Walworth Co., New York, N. Y.

RECIPROCATING PUMPS

See Pumps, Reciprocating

RECORDER-CONTROLLERS, COMBINED TEMPERATURE AND HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.

● Advertisement in this issue. See Index to Advertisers, page 282.

Mason-Neilan Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDER-CONTROLLERS, HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDER-CONTROLLERS, PRESSURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instrument Co., Chicago, Ill.

RECORDER-CONTROLLERS, TEMPERATURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instruments Co., Chicago, Ill.

RECORDERS, CARBON DIOXIDE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Precision Control Co., San Francisco, Cal.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, COMBINED TEMPERATURE AND HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Powers Regulator Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, DRAFT

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Foxboro Co., Foxboro, Mass.
●Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Republic Flow Meters Co., Chicago, Ill.
Uehling Instrument Co., Paterson, N. J.

RECORDERS, HUMIDITY

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Powers Regulator Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.

RECORDERS, LIQUID LEVEL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
●Cochrane Corp., Philadelphia, Pa.
Foxboro Co., Foxboro, Mass.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
Leeds & Northrup Co., Philadelphia, Pa.
Liquidometer Corp., Long Island City, N. Y.
Mason-Neilan Regulator Co., Boston, Mass.
Morey & Jones, Ltd., Los Angeles, Calif.
Republic Flow Meters Co., Chicago, Ill.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RECORDERS, PRESSURE AND VACUUM

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., Cambridge, Mass.
Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cochrane Corp., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Uehling Instrument Co., Paterson, N. J.
United States Gauge Co., New York, N. Y.

RECORDERS, TEMPERATURE

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bailey Meter Co., Cleveland, O.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Builders Iron Foundry, Providence, R. I.
●Cochrane Corp., Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
H-B Instrument Co., Philadelphia, Pa.

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Leeds & Northrup Co., Philadelphia, Pa.
Liquidometer Corp., Long Island City, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Powers Regulator Co., Chicago, Ill.
Practical Instrument Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Republic Flow Meters Co., Chicago, Ill.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
Wheelco Instruments Co., Chicago, Ill.

RECORDING THERMOMETERS

See Recorders, Temperature

REDUCERS, SPEED

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Boston Gear Wks., Inc., North Quincy, Mass.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Ideal Commutator Dresser Co., Sycamore, Ill.
Janette Mfg. Co., Chicago, Ill. (Motorized)
Jones Foundry & Machine Co., W. A., Chicago, Ill.
Link-Belt Co., Philadelphia, Pa.
Medart Co., St. Louis, Mo.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y. (Chain speed)
Philadelphia Gear Co., Philadelphia, Pa.
Poole Foundry & Machine Co., Baltimore, Md.
Smith, Inc., Winfield H., Springville, N. Y.
Star Electric Motor Co., Bloomfield, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

REFRIGERANT GAS PURGERS

See Purgers, Refrigerant Gas

REFRIGERANTS

Ansul Chemical Co., Marinette, Wis. (methyl chloride, sulphur dioxide)
Armour Ammonia Wks., Chicago, Ill. (ammonia)
Carbide and Carbon Chemicals Corp., New York, N. Y. (Butane, isobutane, propane, ethane)
du Pont de Nemours & Co., Inc., E. I., The, R. & H. Chemicals Dept., Wilmington, Del. (methyl chloride and methylene chloride, SO_2, trichlorethylene)
du Pont de Nemours & Co., National Ammonia Div., Frankford, Philadelphia, Pa. (ammonia, sulphur dioxide, methyl chloride, "Freon-12")
Kinetic Chemicals, Inc., Wilmington, Del. ("Freon," fluorine)
Liquid Carbonic Corp., Chicago, Ill. (carbon dioxide)
Pennsylvania Salt Mfg. Co., Philadelphia, Pa. (ammonia)
Pure Carbonic, Inc., New York, N. Y. (carbon dioxide)
Solvay Sales Corp., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va. (Methyl chloride, liquid sulphur dioxide, methylene chloride)

REFRIGERATING COMPRESSORS

See Compressors, Refrigerating

REFRIGERATION ACCUMULATORS

See Accumulators, Refrigeration

REFRIGERATION CONTROLS

See Valves, Refrigeration

REFRIGERATION FITTINGS

See Fittings, Refrigeration

REFRIGERATION MANIFOLDS

See Manifolds, Refrigeration

REFRIGERATION VALVES

See Valves, Refrigeration

REGISTERS

Air Control Products, Inc., Muskegon, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
●Auer Register Co., Cleveland, O.
Barber-Colman Co., Rockford, Ill.
Best Register Co., Milwaukee, Wis.
Char-Gale Mfg. Co., Minneapolis, Minn.
Diamond Mfg. Co., Wyoming, Pa.
Elsey Metal Specialties Co., Detroit, Mich.
Gillian Mfg. Co., Detroit, Mich.
Hart & Cooley Mfg. Co., Holland, Mich.
Hendrick Mfg. Co., Carbondale, Pa.
●Independent Register Co., Cleveland, O.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Lamneck Products, Inc., Middletown, O.
Middleton Mfg. & Sales Co., Minneapolis, Minn.
Mueller Furnace Co., L. J., Milwaukee, Wis.
Newman Bros., Inc., Cincinnati, O.
Pacific Gas Radiator Co., Huntington Park, Cal.
Register & Grille Mfg. Co., Brooklyn, N. Y.
Roberts-Hamilton Co., Minneapolis, Minn.
Rock Island Register Co., Rock Island, Ill.
Standard Stamping & Perforating Co., Chicago, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
United States Register Co., Battle Creek, Mich.
●Waterloo Register Co., Waterloo, Ia.

REGULATORS, AIR VELOCITY

●Johnson Service Co., Milwaukee, Wis.
●McDonnell & Miller, Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

REGULATORS, DAMPER SETS

Adams Co., The, Dubuque, Ia.
Air Control Products, Inc., Muskegon, Mich.
California Cornice, Steel & Supply Corp., Los Angeles, Cal.
Gerett Corp., M. A., Milwaukee, Wis.
Goese Mfg. Co., Milwaukee, Wis.
Hart & Cooley Mfg. Co., Holland, Mich.
Joal Mfg. Corp., Toledo, O.
Kerentoff, G. L., Cincinnati, O.
Ohio Products Co., Cleveland, O.
Parker-Kalon Corp., New York, N. Y.
United States Register Co., Battle Creek, Mich.
Young Regulator Co., Cleveland, O.

REGULATORS, DRAFT, COMBUSTION

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Askania Regulator Co., Chicago, Ill.
Au-Temp-Co Corp., New York, N. Y.
Bailey Meter Co., Cleveland, O.
Boiler Room Equipment, Inc., New York, N. Y.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cole-Sullivan Engineering Co., Minneapolis, Minn.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Engineer Co., New York, N. Y.
Field Mfg. Co., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Foster Wheeler Corp., New York, N. Y.
Foxboro Co., Foxboro, Mass.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hagan Corp., Pittsburgh, Pa.
●Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
National Brass Co., Grand Rapids, Mich.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Precision Control Co., San Francisco, Cal.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingeman Mfg. Co., Salem, Mass.
Russell Electric Co., Chicago, Ill.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
●Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Webster Engineering Co., Tulsa, Okla.

REGULATORS, PRESSURE, AIR

American Meter Co., Inc., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Cash Universal Regulator Co., Marshalltown, Ia.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
DeVilbiss Co., The, Toledo, O.
Dockson Corp., Detroit, Mich.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.

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Klipfel Mfg. Co., Chicago. Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Penn Electric Switch Co., Goshen, Ind.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, GAS

American Meter Co., Inc., New York, N. Y.
Askania Regulator Co., Chicago, Ill.
Atlas Valve Co., Inc., Newark, N. J.
Barber Gas Burner Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burdett Mfg. Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Dockson Corp., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Fox Control & Mfg. Co., Cleveland, O.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Harris Calorific Co., The, Cleveland, O.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago. Ill.
Leslie Co., Lyndhurst, N. J.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Col.
Pacific Gas Radiator Co., Huntington Park, Cal.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Pittsburgh Equitable Meter Co., Pittsburgh, Pa.
Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill. (Industrial)
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
●Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Watson & McDaniel Co., Philadelphia, Pa.

REGULATORS, PRESSURE, HOT WATER HEATING SYSTEMS

Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Chicago, Ill.
●Fisher Governor Co., Marshalltown, Ia.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Kainer Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
●Maid-O-Mist, Inc., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
Mueller Co., Decatur, Ill.
Penberthy Injector Co., Detroit, Mich.
Thrush & Co., H. A., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.
White-Rodgers Electric Co., St. Louis, Mo.

REGULATORS, PRESSURE, LIQUID

Atlas Valve Co., Inc., Newark, N. J.
Automatic Control Co., St. Paul, Minn.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Fulton Sylphon Co., Knoxville, Tenn.
General Sales & Products Co., Cohoes, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Healy Ruff Co., St. Paul, Minn.
●Illinois Engineering Co., Chicago, Ill.
Justus Steam Trap Co., Napanoch, N. Y.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., The, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Monitor Controller Co., The, Baltimore, Md.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Shallcross Controls, Inc., Milwaukee, Wis.
●Spence Engineering Co., Inc., Walden, N. Y.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Tryco Products, Inc., Westfield, Mass.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
White-Rodgers Electric Co., St. Louis, Mo.
Williams Gauge Co., Pittsburgh, Pa. (Feed water)

REGULATORS, STATIC PRESSURE, AIR DUCT

Bristol Co., Waterbury, Conn.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.

REGULATORS, TEMPERATURE

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Armstrong Heat Control Co., Portland, Ore.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
Cooper Co., Clark, Philadelphia, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Eastern Engineering Co., New Haven, Conn.

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Eclipse Fuel Engineering Co., Rockford, Ill.
Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
H-B Instrument Co., Philadelphia, Pa.
Hagan Corp., Pittsburgh, Pa.
Herske & Timmis, Inc., New York, N. Y.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Keckley Co., O. C., Chicago, Ill.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Tritrol Co., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Ranco, Inc., Columbus, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
●Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Triplex Mfg. Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Wheelco Instruments Co., Chicago, Ill.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.

RELAYS, ELECTRICAL

Advance Electric Co., Los Angeles, Cal.
●Allen-Bradley Co., Milwaukee, Wis.
American Instrument Co., Silver Spring, Md.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Chicago, Ill.
Bender Warrick Corp., Birmingham, Mich.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cook Electric Co., Chicago, Ill.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
Edison, Inc., Thos. A., Edison Electrical Controls Div., West Orange, N. J.
Electric Controller & Mfg. Co., Cleveland, O.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Magnet Switch Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Russell Electric Co., Chicago, Ill.
Sheer Co., H. M., Quincy, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
●Taylor Instrument Companies, Rochester, N. Y.
Triplex Mfg. Co., Peru, Ind.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Weston Electrical Instrument Corp., Newark, N. J.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.
Zenith Electric Co., Chicago, Ill.

RELIEF VALVES

See Valves, Relief

REPAIR CLAMPS

See Clamps, Pipe Repair

RESEATERS, VALVE

Leavitt Machine Co., Orange, Mass.
Standard Reseater Corp., New York, N. Y.

RINGS, PISTON, FOR COMPRESSORS

American Hammered Piston Ring Div., Koppers Co., Baltimore, Md.
McQuay-Norris Mfg. Co., St. Louis, Mo.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Sealed Power Corp., Muskegon, Mich.

ROD, GAS WELDING

Air Reduction Sales Co., New York, N. Y.
American Agile Corp., Cleveland, O.
American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Cleveland, O.
Bastian-Blessing Co., Chicago, Ill.
Bridgeport Brass Co., Bridgeport, Conn.
●Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Chicago Steel & Wire Co., Chicago, Ill.
Crucible Steel Co. of America, New York, N. Y.
Duraloy Co., Scottdale, Pa. (Stainless)
Imperial Brass Mfg. Co., Chicago, Ill.
International Nickel Co., New York, N. Y.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Maurath, Inc., Cleveland, O.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Page Steel & Wire Division of American Chain & Cable Co., Inc., Monessen, Pa.
●Republic Steel Corp., Cleveland, O.
Revere Copper & Brass, Inc., New York, N. Y.
Roebling's Sons, John A., Trenton, N. J.
Seneca Wire & Mfg. Co., Fostoria, O.
Torchweld Equipment Co., Div. of National Cylinder Gas Co., Chicago, Ill.
Una Welding, Inc., E. Cleveland, O.
Universal Power Corp., Cleveland, O.
Walworth Co., New York, N. Y.
Wickwire Spencer Steel Co., New York, N. Y.
●Youngstown Sheet & Tube Co., Youngstown, O.

ROLLER BEARINGS

See Bearings, Roller

ROOF SPRAYING SYSTEMS

See Systems, Roof Spraying

ROOF VENTILATORS

See Ventilators, Roof

ROOM HUMIDIFIERS

See Humidifiers, Unit, Room Type; and Units, Air Conditioning, Comfort, Winter

ROOM THERMOSTATS

See Thermostats, Room or Wall

ROTARY PUMPS

See Pumps, Rotary

RUBBER BELTING

See Belting, Flat, Rubber

RUBBER PACKING

See Packing, Rubber

RUBBER PIPE

See Pipe and Fittings, Hard Rubber

SAFETY VALVES

See Valves, Safety

SCREENS, SUN REFLECTING

Ingersoll Steel & Disc Co., Chicago, Ill.

SEAMLESS PIPE

See Pipe, Steel, Seamless

SEPARATORS, AIR

Adams Co., R. P., Buffalo, N. Y.
American Injector Co., Detroit, Mich.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Centrifix Corp., Cleveland, O.
●Crane Co., Chicago, Ill.
DeVilbiss Co., The, Toledo, O.
Direct Separator Co., Inc., Syracuse, N. Y.
Hagan Corp., Pittsburgh, Pa.

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●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Keckley Co., O. C., Chicago, Ill.
Leavitt Machine Co., Orange, Mass.
Logan Engineering Co., Chicago, Ill.
Milburn Co., Alexander, Baltimore, Md.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Spencer Turbine Co., Hartford, Conn.
Spray Engineering Co., Somerville, Mass.
●Staynew Filter Corp., Rochester, N. Y.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
Trerice Co., H. O., Detroit, Mich.
Wright-Austin Co., Detroit, Mich.

SEPARATORS, STEAM AND OIL

●Acme Industries, Inc., Jackson, Mich.
Adams Co., R. P., Buffalo, N. Y.
●American District Steam Co., North Tonawanda, N. Y.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Centrifix Corp., Cleveland, O.
●Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Direct Separator Co., Inc., Syracuse, N. Y.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
Hagan Corp., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Kieley & Mueller, Inc., New York, N. Y.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Logan Engineering Co., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
National Valve & Mfg. Co., Pittsburgh, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Schutte & Koerting Co., Philadelphia, Pa.
Stickle Steam Specialties Co., Indianapolis, Ind.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Textite Corp., Chicago, Ill.
●Webster & Co., Warren, Camden, N. J.
Westfalia Separator Co., Bloomfield, N. J.
Wright-Austin Co., Detroit, Mich.

SEWAGE EJECTORS

See Ejectors, Sewage

SHEARS, ELECTRIC, PORTABLE

Black & Decker Mfg. Co., Towson, Md.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
Skilsaw, Inc., Chicago, Ill.
Stanley Electric Tool Div., New Britain, Conn.
Van Dorn Electric Tool Co., Towson, Md.

SHEARS, POWER

Beatty Machine & Mfg. Co., Hammond, Ind.
Bertsch & Co., Inc., Cambridge City, Ind.
Bliss Co., E. W., Toledo, O.
●Buffalo Forge Co., Buffalo, N. Y.
Cincinnati Shaper Co., Cincinnati, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Excelsior Tool & Machine Co., East St. Louis, Ill.
Heartley Machine & Tool Co., Toledo, O.
Hendley & Whittemore, Beloit, Wis.
New Albany Machine Mfg. Co., New Albany, Ind.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Pels & Co., Inc., Henry, New York, N. Y.
Quickwork-Whiting Div. of Whiting Corp., Harvey, Ill.
Rafter Machine Co., Belleville, N. J.
Rock River Machine Co., Inc., Janesville, Wis.
Schatz Mfg. Co., Poughkeepsie, N. Y.
Yoder Co., The, Cleveland, O.

SHEARS AND SNIPS, HAND

Armstrong-Blum Mfg. Co., Chicago, Ill.
Bartlett Mfg. Co., Detroit, Mich.
Beverly Throatless Shear Co., Chicago, Ill.
Bremil Mfg. Co., Erie, Pa.
Clauss Shear Co., Fremont, O.
Crescent Tool Co., Jamestown, N. Y.
G. D. S. Machinery & Supply Co., Inc., New York, N. Y.
Grobet File Corp. of America, New York, N. Y.
Hendley & Whittemore, Beloit, Wis.
Kidder Mfg. Co., Inc., J. F., Burlington, Vt. (Angle)
Marshalltown Mfg. Co., Marshalltown, Ia.
Niagara Machine & Tool Wks., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Rafter Machine Co., Belleville, N. J.
Rupp Forge & Shear Co., Cleveland, O.
Viking Shear Co., Erie, Pa.
Whitney Metal Tool Co., Rockford, Ill.
Wiss & Sons Co., J., Newark, N. J.

SHEAVES

See Pulleys and Sheaves, for Belt Drives

SHEET METAL BRAKES

See Brakes, Sheet Metal

SHEET METAL DUCTS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL FITTINGS

See Ducts and Duct Fittings, Prefabricated

SHEET METAL PUNCHES

See Punches, Sheet Metal

SHEETS, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Fairmont Aluminum Co., Fairmont, W. Va.

SHEETS, CLAD

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Aluminum Co. of America, Pittsburgh, Pa.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Ingersoll Steel & Disc Co., Chicago, Ill.
International Nickel Co., New York, N. Y.
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.
Wheeling Metal & Mfg. Co., Wheeling, W. Va.

SHEETS, COPPER

American Brass Co., Waterbury, Conn.
American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Downs-Smith Brass & Copper Co., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
National Brass & Copper Co., Inc., Lisbon, O.
New Haven Copper Co., Seymour, Conn.
Revere Copper & Brass, Inc., New York, N. Y.
United States Brass & Copper Co., Hyde Park, Boston, Mass.

SHEETS, LEAD

Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Downs-Smith Brass & Copper Co., New York, N. Y.
Eagle-Picher Lead Co., Cincinnati, O.
Flemm Lead Co., Inc., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Rochester Lead Wks., Rochester, N. Y.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

SHEETS, STEEL, COPPER BEARING

●American Rolling Mill Co., The, Middletown, O.
Apollo Steel Co., Apollo, Pa.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Bethlehem Steel Co., Bethlehem, Pa.
●Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
●Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Follansbee Steel Corp., Pittsburgh, Pa.
Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Otis Steel Co., Cleveland, O.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
●Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube, Co., Youngstown, O.

SHEETS, STEEL, GALVANIZED

●American Rolling Mill Co., The, Middletown, O.
Apollo Steel Co., Apollo, Pa.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Bethlehem Steel Co., Bethlehem, Pa.
●Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
●Columbia Steel Co. (Sub. United States Steel Corp.), San Francisco, Cal.
Continental Steel Corp., Kokomo, Ind.
Crucible Steel Co. of America, New York, N. Y.
Empire Sheet & Tin Plate Co., Mansfield, O.

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Granite City Steel Co., Granite City, Ill.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Lukens Steel Co., Coatesville, Pa.
Lyon, Conklin & Co., Inc., Baltimore, Md.
National Steel Corp., Pittsburgh, Pa.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
Niles Rolling Mill Co., Niles, O.
Otis Steel Co., Cleveland, O.
Parkersburg Iron & Steel Co., Parkersburg, W. Va.
Reeves Steel & Mfg. Co., Dover, O.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Canton, O.
●Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton Steel Co., Weirton, W. Va.
Wheeling Corrugating Co., Wheeling, W. Va.
Wheeling Steel Corp., Wheeling, W. Va.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, GALVANNEALED

Berger Mfg. Div., Republic Steel Corp., Canton, O.
●Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Continental Steel Corp., Kokomo, Ind.
Granite City Steel Co., Granite City, Ill.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Newport, Ky.
●Republic Steel Corp., Cleveland, O.
Sharon Steel Corp., Sharon, Pa.
Superior Sheet Steel Co., The, Div. of Continental Steel Corp., Canton, O.
●Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
●American Rolling Mill Co., The, Middletown, O.
Barium Stainless Steel Corp., Canton, O.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
Bethlehem Steel Co., Bethlehem, Pa.
●Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Crucible Steel Co. of America, New York, N. Y.
Duriron Co., Inc., Dayton, O.
Ingersoll Steel & Disc Co., Chicago, Ill.
International Nickel Co., New York, N. Y. (Monel, Nickel, Inconel)
Jessop Steel Co., Washington, Pa.
Lukens Steel Co., Coatesville, Pa.
●Republic Steel Corp., Cleveland, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Sharon Steel Corp., Sharon, Pa.
Superior Steel Corp., Pittsburgh, Pa.
Universal-Cyclops Steel Corp., Bridgeville, Pa.

SHEETS, WROUGHT IRON

●Byers Co., A. M., Pittsburgh, Pa.

SHEETS, ZINC

American Nickeloid Co., Peru, Ill. (Nickel and chromium plated)
American Zinc Products Co., Greencastle, Ind.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Hegeler Zinc Co., Danville, Ill.
Illinois Zinc Co., Chicago, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Sales Co., New York, N. Y.

SHUTTERS

See Louvers and Shutters

SLEEVE BEARINGS

See Bearings, Sleeve

SMOKE ALARMS

See Alarms, Smoke

SMOKE GUNS

See Guns and Pots, Smoke and Smudge

SMUDGE POTS

See Guns and Pots, Smoke and Smudge

SOCKET WRENCHES

See Wrenches, Socket

SOLAR HEAT RESISTING SCREENS

See Screens, Sun Reflecting

SOLDER, BRAZING ALLOYS, AND FLUXES

Air Reduction Sales Co., New York, N. Y.
Alpha Metal & Rolling Mills, Inc., Brooklyn, N. Y.
American Brass Co., Waterbury, Conn.
American Solder & Flux Co., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., Brooklyn, N. Y.
Benson Co., Inc., Alex R., Hudson, N. Y.
Burnley Battery & Mfg. Co., North East, Pa.
Eagle-Picher Lead Co., Cincinnati, O.
Gardiner Metal Co., Chicago, Ill.
General Plate Div., Metals & Controls Corp., Attleboro, Mass.
Glaser Lead Co., Inc., Brooklyn, N. Y.
Handy & Harman, New York, N. Y. (Silver)
Hardy, Inc., Charles, New York, N. Y.
Imperial Brass Mfg. Co., Chicago, Ill.
Industrial Service Laboratories, Milwaukee, Wis.
Kester Solder Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Lissberger & Son, Inc., Marks, Long Island City, N. Y.
National Lead Co., New York, N. Y.
Ruby Chemical Co., Columbus, O.
Ryerson & Son, Inc., Jos. T., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SOLENOID VALVES

See Valves, Solenoid

SOOT BLOWERS

See Blowers, Soot

SOUND DEADENING FOR CEILING AND WALL

See Insulation, Ceiling and Wall, Sound Deadening

SOUND DEADENING FOR DUCTS

See Insulation, Duct, Sound Deadening

SOUND INDICATORS

See Indicators, Sound Level

SPEED CHANGERS

See Changers, Speed, Hydraulic Coupling; Changers, Speed, Mechanical

SPEED REDUCERS

See Reducers, Speed

SPIRAL PIPE

See Pipe, Spiral, Riveted and Welded

SPOT WELDERS

See Welders, Spot

SPRAY HUMIDIFIERS

See Humidifiers, Direct, Spray Head

SPRAY NOZZLES

See Nozzles, Spray

SPRINKLER HEADS

See Heads, Sprinkler

SPRINKLER SYSTEM CONTROLS

See Controls, Sprinkler System

STAINLESS STEEL PIPE

See Pipe, Steel, Stainless

STAINLESS STEEL SHEETS

See Sheets, Steel, Stainless

STANDS, PIPE VISE

American Pipe Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Crown Die & Tool Co., Chicago, Ill.
Hollands Mfg. Co., Erie, Pa.
Martin & Sons, H. P., Owensboro, Ky.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Western Wire Products Co., St. Louis, Mo.
●Williams & Co., J. H., New York, N. Y.

STEAM BOOSTER COMPRESSORS

See Compressors, Steam Booster

STEAM ENGINES

See Engines, Steam

STEAM JET REFRIGERATION

See Compressors, Refrigerating, Steam Jet

STEAM PRESSURE REGULATORS

See Valves, Pressure Reducing and Regulating

STEAM PUMPS

See Pumps, Steam

STEAM SEPARATORS

See Separators, Steam and Oil

STEAM TRAPS

See Traps, Steam

STEEL PIPE

See Pipe, Steel

STEEL TUBING

See Tubing, Steel

STEEL UNIONS

See Unions, Steel

STEEL VALVES

See Valves, Gate; and Valves, Globe

STERILIZING LAMPS

See Lamps, Sterilizing, for Duct Installation

STOCKS AND DIES

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O.
Champion Blower & Forge Co., Lancaster, Pa.
Crown Die & Tool Co., Chicago, Ill.

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Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Oster Mfg. Co., Cleveland, O.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Walworth Co., New York, N. Y.

STOKERS, INDUSTRIAL AND COMMERCIAL

61 to 1200 Lb per Hr

American Coal Burner Co., Chicago, Ill.
American Engineering Co., Philadelphia, Pa.
Anchor Stove & Range Co., New Albany, Ind.
Auburn Foundry, Inc., Stoker Div., Auburn, Ind.
Automatic Stoker Corp., Milwaukee, Wis.
Babcock & Wilcox Co., New York, N. Y.
Bluffton Mfg. Co., The, Findlay, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Burke Stoker & Mfg. Co., Chicago, Ill.
Burnham Stoker Co., Vancouver, Wash.
Butler Street Foundry & Iron Co., Chicago, Ill.
Canton Stoker Corp., Canton, O.
Carnes, Inc., John R., Lima, O.
Chesapeake & Ohio R. R. Co., Cleveland, O.
Clizbe Bros. Mfg. Co., Plymouth, Ind.
Columbus Metal Products, Inc., Columbus, O.
Combustion Engineering Co., Inc., New York, N. Y.
Crown Iron Works, Minneapolis, Minn.
Delta Stoker Co., North Chicago, Ill.
Detroit Stoker Co., Detroit, Mich.
Econocol Stoker Div. of Cotta Transmission Corp., Rockford, Ill.
Eddy Stoker Corp., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Firemood Machine Wks., Converse, Ind.
Flynn & Emrich Co., Baltimore, Md.
Frederick Iron & Steel Co., Frederick, Md.
Fuel Savers, Inc., Harrisburg, Pa.
Gehl Bros. Mfg. Co., West Bend, Wis.
General Machinery Co., Spokane, Wash.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Heating Assurance, Inc., Spokane, Wash.
Her-Born Engrg. & Mfg. Co., Sandusky, O.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Hoffman Combustion Engineering Co., Detroit, Mich.
Holcomb & Hoke Mfg. Co., Indianapolis, Ind.
Illinois Iron & Bolt Co., Chicago, Ill.
International Engineering Wks., Inc., Framingham, Mass.
Iron Fireman Mfg. Co., Cleveland, O.
Johnston & Jennings Co., Cleveland, O.
Kol-Master Corp., Oregon, Ill.
Laclede Stoker Co., St. Louis, Mo.
Leffel & Co., Springfield, O.
Link-Belt Co., Chicago, Ill.
"Loyal Knight" Stokers, Inc., Belleville, Ill.
Mallory Sales Co., Dolton, Ill.
Marion Machine Foundry & Supply Co., Marion, Ind.
Muncie Gear Wks., Inc., Muncie, Ind.
National Steam Pump Co., Upper Sandusky, O.
Neemes Foundry, Inc., Troy, N. Y.
Ormsby-Osterman Co., St. Louis, Mo.
Orr & Sembower, Inc., Reading, Pa.
Perfection Grate & Stoker Co., Springfield, Mass.
Riley Stoker Corp., Worcester, Mass.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Schwitzer-Cummins Co, Indianapolis, Ind.
Sinker-Davis Co., Indianapolis, Ind.
Spencer Heater Div., Lycoming Mfg. Co., Williamsport, Pa.
Standard Stoker Corp., The, New Albany, N. Y.
Steel Products Engineering Co., Springfield, O.
Stok-A-Fire Co., University City, Mo.
Stokermatic Co., Salt Lake City, Utah.
Taylor Engineering Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiting Corp., Harvey, Ill.
Will-Burt Co., The Orrville, O.

STONEWARE PIPE

See Pipe and Fittings, Stoneware

STORAGE WATER HEATERS

See Heaters, Water, Steam, Storage

STRAINERS, PIPE LINE

Alten's Foundry & Machine Works, Lancaster, O.
●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
●Anderson Co., V. D., The, Cleveland, O.
●Automatic Products Co., Milwaukee, Wis.
Barrett, Haentjens & Co., Hazleton, Pa.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Blackmer Pump Co., Grand Rapids, Mich.
Boylston Steam Specialty Co., Chicago, Ill.
Buffalo Meter Co., Buffalo, N. Y.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
Central Brass Mfg. Co., Cleveland, O.
●Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Cuno Engineering Corp., Meriden, Conn.
Davis Regulator Co., Chicago, Ill.
Direct Separator Co., Inc., Syracuse, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
●Fisher Governor Co., Marshalltown, Ia.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
Foster Engineering Co., Newark, N. J.
Foster Pump Works, Inc., Brooklyn, N. Y.
●Grinnell Co., Providence, R. I.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, New York, N. Y.
Kinney Mfg. Co., Boston, Mass.
Kraissl Co., Inc., The, Hackensack, N. J.
Leslie Co., Lyndhurst, N. J.
●Maid-O-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Long Island City, N. Y.
Newark Wire Cloth Co., Newark, N. J.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Phillips & Co., H. A., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rosedale Foundry & Machine Co., Pittsburgh, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., New York, N. Y.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Scientific Instrument Co., Detroit, Mich.
Sheffler-Gross Co., Philadelphia, Pa.
●Spence Engineering Co., Walden, N. Y.
Spray Engineering Co., Somerville, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Sterling, Inc., Milwaukee, Wis.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, Syracuse, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Trimount Rotary Power Co., East Dedham, Mass.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Worthington-Gamon Meter Co., Harrison, N. J.
Wright-Austin Co., Detroit, Mich.

STRESS RELIEVERS

See Preheaters and Stress Relievers, Electric, for Pipe Welds

STRIP HEATERS

See Heaters, Strip and Immersion, Electric

STRUCTURAL SHAPES

See Angles, Bars, Beams, Channels and Tees

SUMP PUMPS

See Pumps, Sump

SUPERHEATERS, PROCESS STEAM

Edge Moore Iron Works, Inc., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Johnston Bros., Inc., Ferrysburg, Mich.
●Marley Co., Kansas City, Kan.
Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.
Selas Co., The, Philadelphia, Pa.

SURFACE, FINNED, COOLING, BRINE

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
American Coils, Inc., Newark, N. J.
●Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Drayer & Hanson, Inc., Los Angeles, Cal.
●G. & O. Mfg. Co., New Haven, Conn.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.

● Advertisement in this issue. See Index to Advertisers, page 282.

●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Super Radiator Corp., Minneapolis, Minn.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Wolverine Tube Co., Detroit, Mich.
XL Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, COOLING, COLD WATER

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
●Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
●Peerless of America, Inc., Chicago, Ill.
Perfex Corp. (Unit Heater Div.), Milwaukee, Wis.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
Wolverine Tube Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, COOLING, DIRECT EXPANSION

●Acme Industries, Inc., Jackson, Mich.
Advanced Refrigerating Systems Co., Philadelphia, Pa.
●Aerofin Corp., Syracuse, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
American Coils, Inc., Newark, N. J.
●Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Conditionaire Unit Co., Chicago, Ill.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Griscom-Russell Co., The, New York, N. Y.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Larkin Coils, Inc., Atlanta, Ga.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Mojonnier Bros. Co., Chicago, Ill.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Reliance Refrigerating Machine Co., Chicago, Ill.
Rempe Co., Chicago, Ill.
Roessing Mfg. Co., Pittsburgh, Pa.
Rome-Turney Radiator Co., Rome, N. Y.
Standard Galvanizing Co., Chicago, Ill.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Wolverine Tube Co., Detroit, Mich.
X L Refrigerating Co., Chicago, Ill.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE, FINNED, HEATING, INDIRECT, FERROUS

●Airtherm Mfg. Co., St. Louis, Mo.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Bayley Blower Co., Milwaukee, Wis.
●Burnham Boiler Co., Irvington, N. Y.
Foster Wheeler Corp., New York, N. Y.
Griscom-Russell Co., The, New York, N. Y.
●Murray Mfg. Co., D. J., Wausau, Wis.
New York Blower Co., Chicago, Ill.
Tenney Engineering, Inc., Bloomfield, N. J.
Wolff & Munier, Inc., New York, N. Y. (For panel heating)

SURFACE, FINNED, HEATING, INDIRECT, NON-FERROUS

●Aerofin Corp., Syracuse, N. Y.
American Coils, Inc., Newark, N. J.
Bayley Blower Co., Milwaukee, Wis.
●Beacon-Morris Corp., Boston, Mass.
Bohn Aluminum & Brass Corp., Detroit, Mich.
Bush Mfg. Co., Hartford, Conn.
Campbell Heating Co., E. K., Kansas City, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Wheeler Corp., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●G. & O. Mfg. Co., New Haven, Conn.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Griscom-Russell Co., The, New York, N. Y.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Johnson Fan & Blower Corp., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
●Marlo Coil Co., St. Louis, Mo.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
●Murray Mfg. Co., D. J., Wausau, Wis.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
●Peerless of America, Inc., Chicago, Ill.
Perfex Corp (Unit Heater Div.), Milwaukee, Wis.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Super Radiator Corp., Minneapolis, Minn.
Tenney Engineering, Inc., Bloomfield, N. J.
●Tilco-Fin Inc., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
●Wing Mfg. Co., L. J., New York, N. Y.
Wolverine Tube Co., Detroit, Mich.
Yates-American Machine Co., Beloit, Wis.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

SURFACE THERMOSTATS

See Thermostats, Surface

SWING JOINTS

See Joints, Flexible Swing

SWITCHES, ELECTRICAL

Adam Electric Co., Frank, St. Louis, Mo.
●Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn
Automatic Switch Co., New York, N. Y.
Clark Controller Co., Cleveland, O.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Delta-Star Electric Co., Chicago, Ill.
Dunn, Inc., Struthers, Philadelphia, Pa.
Electric Controller & Mfg. Co., Cleveland, O.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.

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Marsh Corp., Jas. P., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Micro Switch Corp., Freeport, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Struthers Dunn, Inc., Philadelphia, Pa.
Tork Clock Co., Inc., Mount Vernon, N. Y.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mount Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, FLOAT, REFRIGERATION

●Alco Valve Co., St. Louis, Mo.
Clark Controller Co., Cleveland, O.
●Frick Co., Waynesboro, Pa.
●McDonnell & Miller, Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Square D Co., Milwaukee, Wis.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.

SWITCHES, FLOW

●McDonnell & Miller, Chicago, Ill.

SWITCHES, LIQUID LEVEL

●Allen-Bradley Co., Milwaukee, Wis.
Arrow-Hart & Hegeman Elect. Co., Hartford, Conn.
Automatic Control Co., St. Paul, Minn.
Bender Warrick Corp., Birmingham, Mich.
Bennett Co., Omaha, Neb.
Cissell Mfg. Co., W. M., Louisville, Ky.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Hart Mfg. Co., Hartford, Conn.
Healy Ruff Co., St. Paul, Minn.
Kisco Boiler & Engineering Co., St. Louis, Mo.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schaub Engineering Co., Fred H., Chicago, Ill.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Trumbull Electric Mfg. Co., Plainville, Conn.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.

SWITCHES, MERCURY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Durakool, Inc., Elkhart, Ind.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

SWITCHES, PRESSURE AND VACUUM

●Allen-Bradley Co., Milwaukee, Wis.
Au-Temp-Co Corp., New York, N. Y.
Automatic Control Co., St. Paul, Minn.
Boston Auto Gage Co., Pittsfield, Mass.
Clark Controller Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Marsh Corp., Jas. P., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monitor Controller Co., The, Baltimore, Md.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Spencer Thermostat Co., Attleboro, Mass.
Square D Co., Detroit, Mich.
Square D Co., Milwaukee, Wis.
Uniflow Mfg. Co., Erie, Pa.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
White-Rodgers Electric Co., St. Louis, Mo.

SWITCHES, TIME

Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
Guardian Electric Mfg. Co., Chicago, Ill.
Herske & Timmis, Inc., New York, N. Y.
Industrial Engineering Corp., Evansville, Ind.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Paragon Electric Co., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Reliance Automatic Lighting Co., Racine, Wis.
Rhodes, Inc., M. H., Hartford, Conn.
Sampsel Time Control, Inc., Spring Valley, Ill.
Sangamo Electric Co., Springfield, Ill.
Spencer Thermostat Co., Attleboro, Mass.
Tork Clock Co., Inc., Mount Vernon, N. Y.
●Ward Leonard Electric Co., Mt. Vernon, N. Y.
White-Rodgers Electric Co., St. Louis, Mo.

SYSTEMS, COMBUSTION CONTROL

Askania Regulator Co., Chicago, Ill.
Bailey Meter Co., Cleveland, O.
Bowser & Co., Inc., S. F., Fort Wayne, Ind.
Bristol Co., Waterbury, Conn.
Brooke Engineering Co., Inc., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Engineer Co., New York, N. Y.
Foster Wheeler Corp., New York, N. Y.
Hagan Corp., Pittsburgh, Pa.
Hays Corp., Michigan City, Ind.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
National Brass Co., Grand Rapids, Mich.
Republic Flow Meters Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Shallcross Controls, Inc., Milwaukee, Wis.
Wheelco Instrument Co., Chicago, Ill.

SYSTEMS, HEATING, HOT WATER

●Bell & Gossett Co., Chicago, Ill.
General Blower Co., Inc., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Kainer & Co., Chicago, Ill.
Kehm Corp., The, Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Maid-O-Mist, Inc., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Penberthy Injector Co., Detroit, Mich.
Sterling, Inc., Milwaukee, Wis.
Sullivan Valve & Engineering Co., Butte, Mont.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Watts Regulator Co., Lawrence, Mass.

SYSTEMS, HEATING, VACUUM

Anderson Products, Inc., Cambridge, Mass.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
Cashin, W. D., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, VAPOR

●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
Herske & Timmis, Inc., New York, N. Y.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
●Sarco Co., Inc., New York, N. Y.

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Sterling, Inc., Milwaukee, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

SYSTEMS, HEATING, ZONE CONTROL

Armstrong Heat Control Co., Portland, Ore.
●Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
Barnes & Jones, Inc., Boston, Mass.
●Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
Herske & Timmis, Inc., New York, N. Y.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Marsh Tritrol Co., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Raymond Co., F. I., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
●Spence Engineering Co., Inc., Walden, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
Thrush & Co., H. A., Peru, Ind.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

SYSTEMS, PROCESS HEATING, HIGH TEMPERATURE

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Dow Chemical Co., Midland, Mich.
Foster Wheeler Corp., New York, N. Y.
Parks-Cramer Co., Fitchburg, Mass.
Ross Engineering Corp., J. O., New York, N. Y.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Williams, Inc., F. C., Dearborn, Mich.

SYSTEMS, ROOF SPRAYING (FOR COOLING ROOFS)

April Showers Co., Washington, D. C.
Ross Sprinkler Co., Pasadena, Cal.
Schubert-Christy Corp., St. Louis, Mo.

SYSTEMS, SPRINKLER, FOR AIR CONDITIONING DUCT SYSTEMS

Rockwood Sprinkler Co., Worcester, Mass.

TANKS, PROCESS AND STORAGE

Aluminum Co. of America, Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y.
American Locomotive Co., Alco Products Div., New York, N. Y.
American-Marsh Pumps, Inc., Battle Creek, Mich.
Ames Iron Works, Div. of Pierce Butler Radiator Corp., Oswego, N. Y.
Bigelow Co., New Haven, Conn.
Biggs Boiler Wks. Co., E. Akron, O.
Bros Boiler & Mfg. Co., Wm., Minneapolis, Minn.
Brownell Co., Dayton, O.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Caldwell Co., W. E., Louisville, Ky.
Case & Son Mfg. Co., W. A., Buffalo, N. Y.
Chicago Bridge & Iron Co., Chicago, Ill.
●Cochrane Corp., Philadelphia, Pa.
Columbian Steel Tank Co., Kansas City, Mo.
Connery Construction Co., Philadelphia, Pa.
Continental Diamond Fibre Co., Newark, Del.
Dahlquist Mfg. Co., Inc., Boston, Mass.
Devine Mfg. Co., Inc., J. P., Mt. Vernon, Ill.
Dillon Steam Boiler Wks., Inc., D. M., Fitchburg, Mass.
Downingtown Iron Wks., Downingtown, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Falstrom Co., Passaic, N. J.
Farquhar Co., Ltd., A. B., York, Pa.
Farrar & Trefts, Buffalo, N. Y.
Frank Heaters, Inc., Paterson, N. J.
Gerstein & Cooper Co., South Boston, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Graver Tank & Mfg. Co., Inc., East Chicago, Ind.
Hamburg Boiler Wks., Inc., Hamburg, Pa.
Harris & Co., Arthur, Chicago, Ill.
Illinois Oil Co., Rock Island, Ill.
International Boiler Wks. Co., East Stroudsburg, Pa.
International Engineering Wks., Framingham, Mass.
●Kewanee Boiler Corp., Kewanee, Ill.
Kirk & Blum Mfg. Co., Cincinnati, O.
Kisco Boiler & Engineering Co., St. Louis, Mo.
Koven & Bro., Inc., L. O., Jersey City, N. J.
La Crosse Tractor Co., La Crosse, Wis.
Lead Lined Iron Pipe Co., Wakefield, Mass.
Littleford Bros., Cincinnati, O.
Manitowoc Boiler Wks., Manitowoc, Wis.
Mauck Seamless Copper Tank Co., Victor, Norristown, Pa.
Milwaukee Reliance Boiler Wks., Milwaukee, Wis.
Murray Iron Wks. Co., Burlington, Ia.
National Lead Co., New York, N. Y.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Quaker City Iron Wks., Philadelphia, Pa.
Richmond Engineering Co., Inc., Richmond, Va.
Roessing Mfg. Co., Pittsburgh, Pa.
Scaife Co., Oakmont, Pa.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Tippett & Wood, Phillipsburg, N. J.
Titusville Iron Wks. Co., Titusville, Pa.
Trageser Steam Copper Wks., John, Maspeth, Long Island, N. Y.
Uniflow Mfg. Co., Erie, Pa.
United States Rubber Co., New York, N. Y.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Wheeling Steel Corp., Wheeling, W. Va. (Heater)
Whitehead Metal Products Co. of New York, Inc., New York, N. Y.
●Whitlock Mfg. Co., Hartford, Conn.

TEMPERATURE AND HUMIDITY CONTROLS

See Humidistats; Recorder-Controllers; Thermostats

TEMPERATURE RECORDERS

See Recorders, Temperature

TEMPERATURE REGULATORS

See Regulators, Temperature

THERMOMETERS, INDICATING, INDUSTRIAL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
Hill, E. Vernon, Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Mason-Neilan Regulator Co., Boston, Mass.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y.
Weston Electrical Instrument Corp., Newark, N. J.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, INDICATING, REMOTE-READING

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard, Inc., Charles, Newark, N. J.
Fee & Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
H-B Instrument Co., Philadelphia, Pa.
●Hays Corp., Michigan City, Ind.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Powers Regulator Co., Chicago, Ill.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
●Sarco Co., Inc., New York, N. Y.
Scientific Instrument Co., Detroit, Mich.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, INDICATING, WALL

American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
American Thermometer Co., St. Louis, Mo.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

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Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.
Engelhard Inc., Charles, Newark, N. J.
Fee and Stemwedel, Inc., Chicago, Ill.
Foxboro Co., Foxboro, Mass.
G. M. Mfg. Co., New York, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hill, E. Vernon, Chicago, Ill.
●Illinois Testing Laboratories, Inc., Chicago, Ill.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Corp., Jas. P., Chicago, Ill.
Martocello & Co., Jos. A., Philadelphia, Pa.
Moeller Instrument Co., Richmond Hill, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Philadelphia Thermometer Co., Philadelphia, Pa.
Precision Thermometer & Instrument Co., Philadelphia, Pa.
Pyrometer Instrument Co., New York, N. Y.
Rochester Mfg. Co., Rochester, N. Y.
Standard Thermometer, Inc., Boston, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
Trerice Co., H. O., Detroit, Mich.
United States Gauge Co., New York, N. Y.
Weksler Thermometer Corp., New York, N. Y. (Effective temperature indicator)
Weston Electrical Instrument Corp., Newark, N. J.
Wheelco Instruments Co., Chicago, Ill.

THERMOMETERS, KATA

G. M. Mfg. Co., New York, N. Y.
Palmer Co., Cincinnati (Norwood), O.
Precision Thermometer & Instrument Co., Philadelphia, Pa.

THERMOSTATIC BELLOWS

See Bellows, Thermostatic

THERMOSTATIC BI-METALS

See Bi-Metals, Thermostatic

THERMOSTATIC TRAPS

See Traps, Steam, Thermostatic

THERMOSTATS, DUCT TYPE

Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Burling Instrument Co., Newark, N. J.
Cook Electric Co., Chicago, Ill.
D & M Mfg. Co., Midland Park, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Leslie Co., Lyndhurst, N. J.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Philadelphia Thermometer Co., Philadelphia, Pa.
Powers Regulator Co., Chicago, Ill.
●Sarco Co., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, EFFECTIVE TEMPERATURE

Barber-Colman Co., Rockford, Ill.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.

THERMOSTATS, IMMERSION

American Instrument Co., Silver Spring, Md.
Atlas Valve Co., Inc., Newark, N. J.
Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Burling Instrument Co., Newark, N. J.
D & M Mfg. Co., Midland Park, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A. Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
General Electric Co., Schenectady, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Powers Regulator Co., Chicago, Ill.
Precision Thermometer & Instrument Co., Philadelphia, Pa
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
Thwing-Albert Instrument Co., Philadelphia, Pa.
United Electric Controls Co., Boston, Mass.
Warren Electric Appliance Co., Warren, Pa.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.
Wilcolator Co., Newark, N. J.

THERMOSTATS, ROOM OR WALL

Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Cook Electric Co., Chicago, Ill.
Crise Elec. Mfg. Co., Mt. Vernon, O.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Fulton Sylphon Co., Knoxville, Tenn.
●General Controls Co., Glendale, Cal.
●General Electric Co., Schenectady, N. Y.
Gleason-Avery, Inc., Auburn, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Magnet Switch Co., Chicago, Ill.
McCorkle Co., D. H., Berkeley, Calif.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Powers Regulator Co., Chicago, Ill.
Russell Electric Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Standard Thermometer, Inc., Boston, Mass.
Superstat Co., Springfield, Mass.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Webster Tallmadge & Co., East Orange, N. J.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, SURFACE

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
●Detroit Lubricator Co., Detroit, Mich.
Dunn, Inc., Struthers, Philadelphia, Pa.
Edison, Inc., Thomas A., Edison Electric Controls Div., West Orange, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hart Mfg. Co., Hartford, Conn.
Jefferson Electric Co., Bellwood, Ill.
McCorkle Co., D. H., Berkeley, Cal.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The Dayton, Ohio.
Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Struthers Dunn, Inc., Philadelphia, Pa.
Superstat Co., Springfield, Mass.
United Electric Controls Co., Boston, Mass.
White Mfg. Co., St. Paul, Minn.
White-Rodgers Electric Co., St. Louis, Mo.

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THERMOSTATS, TWO TEMPERATURE OR DUAL

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Burling Instrument Co., Newark, N. J.
●Detroit Lubricator Co., Detroit, Mich.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
Gleason-Avery, Inc., Auburn, N. Y.
H-B Instrument Co., Philadelphia, Pa.
Herske & Timmis, Inc., New York, N. Y.
●Illinois Engineering Co., Chicago, Ill.
Jefferson Electric Co., Bellwood, Ill.
●Johnson Service Co., Milwaukee, Wis.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pioneer Heat Regulator Div., Master Electric Co., The, Dayton, O.
Powers Regulator Co., Chicago, Ill.
Ranco, Inc., Columbus, O.
●Sarco Co., Inc., New York, N. Y.
Superstat Co., Springfield, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
United Electric Controls Co., Boston, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Walker and Eder, Inc., New York, N. Y.
White-Rodgers Electric Co., St. Louis, Mo.

THERMOSTATS, WEATHER COMPENSATING

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Detroit Lubricator Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.
Herske & Timmis, Inc., New York, N. Y.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leeds & Northrup Co., Philadelphia, Pa.
Marsh Tritrol Co., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Thrush & Co., H. A., Peru, Ind.
United Electric Controls Co., Boston, Mass.
Walker and Eder, Inc., New York, N. Y.

TIME SWITCHES

See Switches, Time

TOGGLE BOLTS

See Bolts, Toggle and Anchor

TONGS, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Jarecki Mfg. Co., Erie, Pa.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., New York, N. Y.

TOOLS (CHISELS, PLIERS, SCREW DRIVERS, ETC.)

Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
International Nutyp Tool Co., Oswego, N. Y.
Parker-Kalon Corp., New York, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

TORCHES, BRAZING

Aeroil Burner Co., Inc., West New York, N. J.
Air Reduction Sales Co., New York, N. Y.
Bastian-Blessing Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Burdett Mfg. Co., Chicago, Ill.
Clayton & Lambert Mfg. Co., Detroit, Mich.
Dockson Corp., Detroit, Mich.
Gasweld Equipment Co., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Insto-Gas Corp., Detroit, Mich.
Johnson Gas Appliance Co., Cedar Rapids, Ia.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Marquette Mfg. Co., Minneapolis, Minn.
Milburn Co., Alexander, Baltimore, Md.
Minn-Kota Foundry & Mfg. Co., Fargo, N. D.
Modern Engineering Co., St. Louis, Mo.
Reiner & Campbell, Inc., New York, N. Y.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Co., Minneapolis, Minn.
Torchweld Equipment Co., Div. of National Cylinder Gas Co., Chicago, Ill.
Welding Apparatus Co., Chicago, Ill.

TORQUE INDICATING WRENCHES

See Wrenches, Torque Indicating

TOWERS, COOLING, ATMOSPHERIC

American Cooling Tower Co., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Mo.
New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Stewart Ice Machine Co., Los Angeles, Cal.
Tippett & Wood, Phillipsburg, N. J.
Water Cooling Tower Co., Chicago, Ill.

TOWERS, COOLING, MECHANICAL DRAFT

American Cooling Tower Co., Kansas City, Mo.
●Binks Mfg. Co., Chicago, Ill.
Burhorn Co., Edwin, New York, N. Y.
Fluor Corp., Ltd., The, Los Angeles, Cal.
Foster Wheeler Corp., New York, N. Y.
Harry Cooling Towers, Inc., New York, N. Y.
●Hess Warming & Ventilating Co., Chicago, Ill.
Lilie-Hoffmann Cooling Towers, Inc., St. Louis, Mo.
●Marley Co., Kansas City, Mo.
New England Cooling Tower Co., Boston, Mass.
Pennsylvania Engineering Wks., New Castle, Pa.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Propellair, Inc., Springfield, O.
Research Corp., New York, N. Y.
Schubert-Christy Corp., Affton, St. Louis, Mo.
Water Cooling Tower Co., Chicago, Ill.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

TRANSMISSION DRIVES

See Drives, Chain, Flat Belt and V-Belt

TRAPS, STEAM, MECHANICAL

●American District Steam Co., North Tonawanda, N. Y.
●Anderson Co., V. D., The, Cleveland, O.
●Armstrong Machine Wks., Three Rivers, Mich.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Boylston Steam Specialty Co., Chicago, Ill.
Bundy Steam Trap Co., Nashua, N. H.
Burrows Mfg. Co., F. A., York, Pa.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., Boston, Mass.
●Cochrane Corp., Philadelphia, Pa.
Coe Mfg. Co., Painesville, O.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
Davis Regulator Co., Chicago, Ill.
●Dunham Co., C. A., Chicago, Ill.
Ellis Drier Co., Chicago, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Haines & Co., William S., Philadelphia, Pa.
Healy Ruff Co., St. Paul, Minn.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Johnson Corp., Three Rivers, Mich.
Justus Steam Trap Co., Napanoch, N. Y.
Kaye & MacDonald, Inc., West Orange, N. J.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Lytton Mfg. Co., Franklin, Va.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
McAuley Trap Co., Pittsburgh, Pa.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Morehead Mfg. Co., Detroit, Mich.
Mouat Vapor Heating Co., The, Cleveland, O.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Nason Co., Detroit, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
●Sarco Co., Inc., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Squires Co., C. E., Cleveland, O.
Star Radiator Co., Los Angeles, Cal.
Sterling, Inc., Milwaukee, Wis.
Sterling Engineering & Mfg. Corp., Hyde Park, Mass.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Templeton Bros., Boston, Mass. (Return)
Trerice Co., H. O., Detroit, Mich.
Vapor Specialty Co., New York, N. Y.
Watson & McDaniel Co., Philadelphia, Pa.

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●Webster & Co., Warren, Camden, N. J.
Williams Gauge Co., Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.
●Yarnall-Waring Co., Philadelphia, Pa.

TRAPS, STEAM, THERMOSTATIC

●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Jamaica Plain, Boston, Mass.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
●Clifford Mfg. Co., Boston, Mass.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Dunham Co., C. A., Chicago, Ill.
Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Huyette Co., Inc., Paul B., Philadelphia, Pa.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

TUBE CLEANERS

See Cleaners, Tube

TUBES, BOILER

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Bigelow Co., New Haven, Conn.
Globe Steel Tubes Co., Milwaukee, Wis.
International Engineering Wks., Inc., Framingham, Mass.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Pittsburgh Steel Co., Pittsburgh, Pa.
Steel & Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
●Youngstown Sheet & Tube Co., Youngstown, O.

TUBES, PITOT

Bacharach Industrial Instrument Co., Pittsburgh, Pa.
Defender Automatic Regulator Co., St. Louis, Mo.
Detroit Air Meter Co., Detroit, Mich.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
Hill, E. Vernon, Chicago, Ill.
Meriam Co., The, Cleveland, O.

TUBING, ALUMINUM

Aluminum Co. of America, Pittsburgh, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.

TUBING BENDERS

See Benders, Tubing

TUBING, BRASS AND COPPER

American Brass Co., Waterbury, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Foster Wheeler Corp., New York, N. Y.
●Hussey & Co., C. G., Pittsburgh, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Parker Appliance Co., Cleveland, O.
Phelps Dodge Copper Products Corp., British American Tube Div., New York, N. Y.
Revere Copper & Brass, Inc., New York, N. Y.
Roberts Tube Works, Detroit, Mich.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
Wolverine Tube Co., Detroit, Mich.

TUBING CUTTERS

See Cutters, Tubing

TUBING, FINNED

●Aerofin Corp., Syracuse, N. Y.
Brown Fintube Co., The, Elyria, O.
Bush Mfg. Co., Hartford, Conn.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●G. & O. Mfg. Co., New Haven, Conn.
Industrial Mfg. & Engineering Co., Chicago, Ill.
Kramer Trenton Co., Trenton, N. J.
Manufacturers Fin Coil Co., Chicago, Ill.
McCord Radiator & Mfg. Co., Detroit, Mich.
●McQuay, Inc., Minneapolis, Minn.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Appliances, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
●Tilco-Fin, Inc., Brooklyn, N. Y.
Vapor Car Heating Co., Inc., Chicago, Ill.
Wolverine Tube Co., Detroit, Mich. (Aluminum, copper)

TUBING, STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bundy Tubing Co., Detroit, Mich.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Globe Steel Tubes Co., Milwaukee, Wis.
Jones & Laughlin Steel Corp., Pittsburgh, Pa.
Laclede Steel Co., St. Louis, Mo.
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
Pittsburgh Steel Co., Pittsburgh, Pa.
South Chester Tube Co., Chester, Pa.
●Spang Chalfant, Inc., Div. of National Supply Co., Pittsburgh, Pa.
Standard Tube Co., Highland Park, Mich.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.
Wheatland Tube Co., Philadelphia, Pa.
●Youngstown Sheet & Tube Co., Youngstown, O.

TUBING, STEEL, STAINLESS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
Babcock & Wilcox Co., New York, N. Y.
Carpenter Steel Co., Reading, Pa.
Colonial Alloys Co., Metals Div., Philadelphia, Pa.
Duraloy Co., Scottdale, Pa.
Globe Steel Tubes Co., Milwaukee, Wis.
International Nickel Co., New York, N. Y. (Monel, nickel, Inconel)
National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.
Timken Steel & Tube Co., Canton, O.

TURBINES, MECHANICAL DRIVE

●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Carling Blower Co., Worcester, Mass.
Coppus Engineering Corp., Worcester, Mass.
Dean Hill Pump Co., Anderson, Ind.
De Laval Steam Turbine Co., Trenton, N. J.
Elliott Co., Jeannette, Pa.
General Electric Co., Schenectady, N. Y.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.
Murray Iron Wks. Co., Burlington, Ia.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Terry Steam Turbine Co., Hartford, Conn.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
●Wing Mfg. Co., L. J., New York, N. Y.

2, 3 AND 4-WAY VALVES

See Valves, 2, 3 and 4-way

UNDERGROUND PIPING

See Conduit, Underground Piping

UNIONS, BRASS

Belknap Mfg. Co., Bridgeport, Conn.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Devlin Mfg. Co., Inc., Thos., Burlington, N. J.
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence, R. I.
Grabler Mfg. Co., Cleveland, O.
Hays Mfg. Co., Erie, Pa.
Jarecki Mfg. Co., Erie, Pa.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwauke, Wis.
Mueller Brass Co., Port Huron, Mich.
Ohio Brass Co., Mansfield, O. (Elbows)
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.

● Advertisement in this issue. See Index to Advertisers, page 282.

Rhode Island Fittings Co., Hillsgrove, R. I.
Standard Union Co., Lockport, N. Y.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.
Williams Valve Co., D. T., Cincinnati, O.

UNIONS, MALLEABLE, BRASS SEAT

Corley Co., Jersey City, N. J.
●Crane Co., Chicago, Ill.
●Dart Mfg. Co., E. M., Providence R. I.
Detroit Brass & Malleable Wks., Detroit, Mich.
Devlin Mfg. Co., Inc., Thos, Burlington, N. J.
●**Fairbanks Co., New York, N. Y.**
Flagg & Co., Inc., Stanley G., Philadelphia, Pa.
General Fittings Co., Providence R. I.
Grabler Mfg. Co., Cleveland, O.
●**Grinnell Co., Inc., Providence, R. I.**
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jefferson Union Co., Lexington, Mass.
Kennedy Valve Mfg. Co., Elmira, N. Y.
King Union Co., Inc., Hillsgrove, R. I.
Lockport Fittings Co., Inc., Lockport, N. Y.
Malleable Iron Fittings Co., Branford, Conn.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rockwood Sprinkler Co., Worcester, Mass.
Standard Union Co., Lockport, N. Y.
Star Mfg. Co., Inc., Providence, R. I.
Stockham Pipe Fittings Co., Birmingham, Ala.
United Superior Union Co., Inc., Brooklyn, N. Y.
Walworth Co., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburg, Pa.

UNIONS, STEEL

Alloy Steel Products Co., Linden, N. J.
Central Forging Co., Catawissa, Pa.
Champion Machine & Forging Co., Cleveland, O.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (Stainless)
●Crane Co., Chicago, Ill.
Rockwood Sprinkler Co., Worcester, Mass.
Roessing Mfg. Co., Pittsburgh, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●**Watson-Stillman Co., Roselle, N. J.**

UNIT COOLERS

See Coolers, Unit

UNIT HEATERS

See Heaters, Unit

UNIT VENTILATORS

See Ventilators, Unit

UNITS, AIR CONDITIONING, CENTRAL STATION TYPE

Self contained blower, heating and/or cooling coil, filter, humidifier unit for remote location and duct air distribution

●**Air & Refrigeration Corp., New York, N. Y.**
Airtemp, Div. of Chrysler Corp., Dayton, O.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
●**Baker Ice Machine Co., Inc., Omaha, Neb.**
Ballantyne Co., Omaha, Nebr.
●**Beacon-Morris Corp., Boston, Mass.** (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●**Buffalo Forge Co., Buffalo, N. Y.**
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
●**Clarage Fan Co., Kalamazoo, Mich.**
Corozone Air Conditioning Corp., Cleveland, O.
●**Curtis Refrigerating Machine Co., St. Louis, Mo.**
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●**Fedders Mfg. Co., Inc., Buffalo, N. Y.**
Forman Machine & Electric Corp., New York, N. Y.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●**General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.**
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Governair Corp., Oklahoma City, Okla.
Hastings Air Conditioning Co., Hastings, Neb.
●**Hoffman Specialty Co., Inc., Waterbury, Conn.**
Howe Ice Machine Co., Chicago, Ill.
●Ilg Electric-Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●**Marlo Coil Co., St. Louis, Mo.**
●**McQuay, Inc., Minneapolis, Minn.**

Micheli Air Conditioning Co., Inc., Schenectady, N. Y.
●Modine Mfg. Co., Racine, Wis.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Niagara Blower Co., New York, N. Y.
Palmer's Mfg. Corp., Phoenix, Ariz.
Pernot & Rich, Inc., Los Angeles, Cal.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Reverse-Air Corp., Chicago, Ill. (Reverse cycle)
Simmons Co., Gordon H., Milwaukee, Wis.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Surface Combustion Corp., Toledo, O.
Tenney Engineering, Inc., Bloomfield, N. J.
●**Trane Co., La Crosse, Wis.**
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**
United States Radiator Corp., Detroit, Mich.
Utica Radiator Corp., Utica, N. Y.
●Vilter Mfg. Co., Milwaukee, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, HORIZONTAL PACKAGE TYPE

Self contained blower, cooling and/or heating coil, filter, humidifier unit for ceiling or platform location in space condition, for connection to remote compressor or cold water supply, and steam or hot water

Airtemp, Div. of Chrysler Corp., Dayton, O.
American Blower Corp., Detroit, Mich.
●**Baker Ice Machine Co., Inc., Omaha, Neb.**
●Beacon-Morris Corp., Boston, Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●**Buffalo Forge Co., Buffalo, N. Y.**
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
Champion Unit Heater Co., Chicago, Ill.
●**Clarage Fan Co., Kalamazoo, Mich.**
Corozone Air Conditioning Corp., Cleveland, O.
●**Curtis Refrigerating Machine Co., St. Louis, Mo.**
Drayer & Hanson, Inc., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
●**Fedders Mfg. Co., Inc., Buffalo, N. Y.**
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●**General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.**
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Hastings Air Conditioning Co., Hastings, Neb.
●**Hoffman Specialty Co., Inc., Waterbury, Conn.**
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kennard, Inc., Sam, St. Louis, Mo.
Kramer Trenton Co., Trenton, N. J.
●Marlo Coil Co., St. Louis, Mo.
Mayflower Air-Conditioners, Inc., St. Paul, Minn.
●**McQuay, Inc., Minneapolis, Minn.**
●Modine Mfg. Co., Racine, Wis.
Niagara Blower Co., New York, N. Y.
Red Jacket Mfg. Co., Davenport, Ia.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Sturtevant Co., B. F., Boston, Mass.
Tenney Engineering, Inc., Bloomfield, N. J.
●**Trane Co., La Crosse, Wis.**
●**U. S. Air Conditioning Corp., Minneapolis, Minn.**
United States Radiator Corp., Detroit, Mich.
●Vilter Mfg. Co., Milwaukee, Wis.
●Webster & Co., Warren, Camden, N. J.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●**Young Radiator Co., Racine, Wis.**

UNITS, AIR CONDITIONING, INDUSTRIAL TYPE

●**Air & Refrigeration Corp., New York, N. Y.**
American Blower Corp., Detroit, Mich.
Anetsberger Bros., Chicago, Ill.
Bahnson Co., Winston-Salem, N. C.
●**Baker Ice Machine Co., Inc., Omaha, Neb.**
●**Beacon-Morris Corp., Boston, Mass.** (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
Brundage Co. Kalamazoo, Mich.
●**Buffalo Forge Co., Buffalo, N. Y.**
●**Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.**
●**Carrier Corp., Syracuse, N. Y.**

● Advertisement in this issue. See Index to Advertisers, page 282.

●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Drayer & Hanson, Inc., Los Angeles, Cal.
Economy Equipment Co., Inc., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
●Frick Co., Waynesboro, Pa.
●General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Howe Ice Machine Co., Chicago, Ill.
Industrial Mfg. & Engineering Co., Chicago, Ill.
International Moistening Co., Providence, R. I.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●Marlo Coil Co., St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
Niagara Blower Co., New York, N. Y.
Norwood Filtration Co., The, Florence, Mass.
Parks-Cramer Co., Fitchburg, Mass.
Pfening Co., Fred D., Columbus, O.
Refrigeration Economics Co., Inc., Canton, O.
Rempe Co., Chicago, Ill.
Research Corp., New York, N. Y.
Ross Engineering Corp., J. O., New York, N. Y.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., St. Louis, Mo.
Somers, Inc., H. J., Detroit, Mich.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
●Surface Combustion Corp., Toledo, O.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, EVAPORATIVE TYPE

For cooling with sprays, no dehumidification

●Air & Refrigeration Corp., New York, N. Y.
Air-O-Line Co., The, Dallas, Tex.
Alter Co., Harry, Chicago, Ill.
American Blower Corp., Detroit, Mich.
American Metal Products Co., Fort Worth, Tex.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Ballantyne Co., Omaha, Nebr.
Bien Air Conditioning Co., Bell, Cal.
Brundage Co., Kalamazoo, Mich.
Campbell Heating Co., E. K., Kansas City, Mo.
Coolmaster Corp., Chicago, Ill.
Dallas Engineering Co., Inc., Dallas, Tex.
Economy Electric Mfg. Co., Chicago, Ill.
Essick Mfg. Co., Los Angeles, Cal.
Fairbanks, Morse & Co., Chicago, Ill.
Great National Air Conditioning Corp., Dallas, Tex.
●Hall Mfg. Co., Cedar Rapids, Ia.
Hammond Aircraft Corp., South San Francisco, Cal.
Little Giant Vaporizer Co., Oklahoma City, Okla.
Montag Stove & Furnace Works, Portland, Ore.
Mountain States Equipment Co., Denver, Col.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Northwest Stove Works, Portland, Ore.
Pacific Gas Radiator Co., Huntington Park, Cal.
Palmer's Mfg. Corp., Phoenix, Ariz.
Payne Furnace & Supply Co., Inc., Beverly Hills, Cal.
Pernot & Rich, Inc., Los Angeles, Cal.
Royal Air Conditioning Equipment Co., Alhambra, Cal.
Shreveport Engineering Co., Inc., Shreveport, La.
Snoair, Dallas, Tex.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Western Blower Co., Seattle, Wash.
X L Refrigerating Co., Chicago, Ill.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE, FLOOR CABINET, REMOTE COMPRESSOR OR COLD WATER, UNDER 3 TONS CAPACITY

Self contained blower, coil, filter unit for connection to remote compressor or cold water supply

Airgard Mfg. Co., Chicago, Ill.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Ballantyne Co., Omaha, Neb.
●Carrier Corp., Syracuse, N. Y.
Crystal Refrigerator Co., Fremont, Nebr.
●Dunham Co., C. A., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
General Air Conditioning Corp., Cincinnati, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
Giant Mfg. Co., Council Bluffs, Ia.
●Hall Mfg. Co., Cedar Rapids, Ia.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
King Ventilating Co., Owatonna, Minn.
●McQuay, Inc., Minneapolis, Minn.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Norwin Co., Freeport, Ill.
●Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Premier Furnace Co., Dowagiac, Mich.
Refrigeration Economics Co., Inc., Canton, O.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, SUMMER, ROOM TYPE, FLOOR CABINET, SELF CONTAINED COMPRESSOR, UNDER 3 HP

Self contained blower, coil, compressor, filter unit

Airmode Mfg. Co., Chicago, Ill.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Apex Rotarex Corp., Cleveland, O.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
Certified Products Co., Toledo, O. (Window sill mounted)
Corozone Air Conditioning Corp., Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Gale Products, Galesburg, Ill.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Governair Corp., Oklahoma City, Okla.
Harvey-Whipple, Inc., Springfield, Mass.
Ice Cooling Appliance Corp., Morrison, Ill. (Ice)
●Ilg Electric Ventilating Co., Chicago, Ill.
Indian Trailer Corp., Koolroom Div., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Meyer Furnace Co., Peoria, Ill.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Philco Radio & Television Corp., Philadelphia, Pa.
Pleasantaire Corp., Washington, D. C.
Premier Furnace Co., Dowagiac, Mich.
Refrigeration Economics Co., Inc., Canton, O.
Standard Stoker Corp., The, New Albany, Ind.
Timken Silent Automatic Div., Timken-Detroit Axle Co., Detroit, Mich.
●Trane Co., La Crosse, Wis.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
York Ice Machinery Corp., York, Pa.

UNITS, AIR CONDITIONING, SUMMER, STORE TYPE, FLOOR CABINET, SELF CONTAINED COMPRESSOR, 3 HP AND OVER

Self contained blower, coil, compressor, filter unit with air discharge approximately 6 ft. above floor

Airtemp, Div., of Chrysler Corp., Dayton, O.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Buffalo Forge Co., Buffalo, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
Fairbanks, Morse & Co., Chicago, Ill.
Forman Machine & Electric Corp., New York, N. Y.
●Frick Co., Waynesboro, Pa.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Niagara Blower Co., New York, N. Y.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
●Trane Co., La Crosse, Wis.
●Vilter Mfg. Co., Milwaukee, Wis.
Williams Oil-O-Matic Heating Corp., Bloomington, Ill.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

● Advertisement in this issue. See Index to Advertisers, page 282.

UNITS, AIR CONDITIONING, WINTER, ROOM TYPE, FLOOR CABINET

Self contained blower, filter, heating coil, humidifier unit

●Air & Refrigeration Corp., New York, N. Y.
Apex Rotarex Corp., Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Campbell Heating Co., Des Moines, Ia.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Drayer & Hanson, Inc., Los Angeles, Cal.
●Dunham Co., C. A., Chicago, Ill.
Easternoil, Inc., Portland, Me.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
●Ilg Electric Ventilating Co., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kennard, Inc., Sam, St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Norge Div., Borg-Warner Corp., Detroit, Mich.
Pan-American Engineering Co., Berkeley, Cal.
●Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Reznor Mfg. Co., Mercer, Pa.
Somers, Inc., H. J., Detroit, Mich.
●Surface Combustion Corp., Toledo, O.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, AIR CONDITIONING, YEAR AROUND, ROOM TYPE, FLOOR CABINET

Self contained blower, cooling and heating coil, filter, humidifier unit for connection to remote compressor or cold water supply, and steam or hot water supply

●Air & Refrigeration Corp., New York, N. Y.
Airtemp, Div. of Chrysler Corp., Dayton, O.
Apex Rotarex Corp., Cleveland, O.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Beacon-Morris Corp., Boston Mass. (Custom built)
Betz Air Conditioning Corp., Kansas City, Mo.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carrier Corp., Syracuse, N. Y.
●Clarage Fan Co., Kalamazoo, Mich.
Corozone Air Conditioning Corp., Cleveland, O.
●Curtis Refrigerating Machine Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Fairbanks, Morse & Co., Chicago, Ill.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., Bloomfield, N. J.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Grinnell Co., Inc., Providence, R. I.
Hastings Air Conditioning Co., Hastings, Neb.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Kelvinator Div., Nash-Kelvinator Corp., Detroit, Mich.
Kennard, Inc., Sam, St. Louis, Mo.
●McQuay, Inc., Minneapolis, Minn.
●Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, Moline, Ill.
●Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
Norge Div., Borg-Warner Corp., Detroit, Mich.
●Peerless of America, Inc., Chicago, Ill.
Perham Products, Inc., Chicago, Ill.
Refrigeration Economics Co., Inc., Canton, O.
Tenney Engineering, Inc., Bloomfield, N. J.
●Trane Co., La Crosse, Wis.
Unified Air Conditioner Co., Duluth, Minn.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
●Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.
York Ice Machinery Corp., York, Pa.
●Young Radiator Co., Racine, Wis.

UNITS, WINDOW VENTILATOR AND FILTER

Ad-Lee Co., Inc., Chicago, Ill.
Airgard Mfg. Co., Chicago, Ill.
Airmode Mfg. Co., Chicago, Ill.
Amirton Co., Elmsford, N. Y.
Berger Mfg. Div., Republic Steel Corp., Canton, O.
●Carrier Corp., Syracuse, N. Y.
Davies Air Filter Corp., New York, N. Y.
Fairbanks, Morse & Co., Chicago, Ill.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
●Ilg Electric Ventilating Co., Chicago, Ill.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Kaiser Co., H. S., Chicago, Ill.
Kauffman Air Conditioning Corp., St. Louis, Mo.
Mellish & Murray Co., Chicago, Ill.
Reed Unit-Fans, Inc., New Orleans, La.
Somers, Inc., H. J., Detroit, Mich.
●Staynew Filter Corp., Rochester, N. Y.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Unified Air Conditioner Co., Duluth, Minn.
Utility Fan Corp., Los Angeles, Cal.

VACUUM GAGES

See Gages, Indicating, Vacuum

VACUUM HEATING SYSTEMS

See Systems, Heating, Vacuum

VACUUM PUMPS

See Pumps, Vacuum Heating

VACUUM RECORDERS

See Recorders, Pressure and Vacuum

VALVE OPERATORS

See Operators, Valve

VALVE RESEATERS

See Reseaters, Valve

VALVES, ANGLE

Albright Equipment Co., Pittsburgh, Pa.
Alloy Steel Products Co., Linden, N. J.
American Brass Co., Waterbury, Conn.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa. (Plug)
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Brass Mfg. Co., Cleveland, O.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, BLOW-OFF

Alloy Steel Products Co., Linden, N. J.
Babcock & Wilcox Co., New York, N. Y.
Barrett Machine Co., N. S. Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
●Cochrane Corp., Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Elliott Co., Jeannette, Pa.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keckley Co., O. C., Chicago, Ill.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Norgren Co., Inc., C. A., Denver, Colo.
Ohio Injector Co., Wadsworth, O.

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Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Yarnall-Waring Co., Philadelphia, Pa.

VALVES, CHECK

Alloy Steel Products Co., Linden, N. J.
Alten's Foundry & Machine Works, Lancaster, O.
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Barrett, Haentjens & Co., Hazleton, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Forging Co., Catawissa, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Cochrane Corp., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Works, Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Henry Valve Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y
Kennedy Valve Mfg. Co., Elmira, N. Y.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Milwaukee Valve Co., Milwaukee, Wis.
Mueller Co., Decatur, Ill.
Mueller Brass Co., Port Huron, Mich.
Norgren Co., Inc., C. A., Denver, Colo.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Rockford Brass Works, Rockford, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass. (Bleeder type)
Schutte & Koerting Co., Philadelphia, Pa.
Smolensky Valve Co., Inc., Cleveland, O.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. J.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Gauge Co., Pittsburgh, Pa. (Noiseless)
Williams Valve Co.. D. T., Cincinnati, O.

VALVES, DIAPHRAGM

American Hard Rubber Co., New York, N. Y. (Rubber lined)
American Schaeffer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Atlas Valve Co., Inc., Newark, N. J.
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
●Cash Co., A. W., Decatur, Ill.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Foxboro Co., Foxboro, Mass.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller Co., Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Northern Indiana Brass Co., Elkhart, Ind.
Parks-Cramer Co., Fitchburg, Mass.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
●Taylor Instrument Companies, Rochester, N. Y.
●Trane Co., La Crosse, Wis.
Trerice Co., H. O., Detroit, Mich.
Triplex Mfg. Co., Peru, Ind.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
White-Rodgers Electric Co.. St. Louis, Mo.

VALVES, FLOAT

Albright Equipment Co., Pittsburgh, Pa.
American Hard Rubber Co., New York, N. Y. (Hard rubber)
Atlas Valve Co., Inc., Newark, N. J.
●Automatic Products Co., Milwaukee, Wis. (Oil)
Belfield Co., H., Philadelphia, Pa.
Boylston Steam Specialty Co., Chicago, Ill.
Caldwell Co., W. E., Louisville, Ky.
●Cash Co., A. W., Decatur, Ill.
Central Brass Mfg. Co., Cleveland, O.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Illinois Engineering Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kieley & Mueller Co., Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Ludlow Valve Mfg. Co., Troy, N. Y.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
●Maid-O-Mist, Inc., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Phillips & Co., H. A., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Schaub Engineering Co., Fred H., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.
Stickle Steam Specialties Co., Indianapolis, Ind.
Swartwout Co., Cleveland, O.
●Trane Co., La Crosse, Wis.
Viking Air Conditioning Corp., Cleveland, O.
Voss Co., J. H. H., New York, N. Y.
Watts Regulator Co., Lawrence, Mass.

VALVES, FORGED STEEL

Albright Equipment Co., Pittsburgh, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Henry Valve Co., Chicago, Ill.
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Parker Appliance Co., Cleveland, O.
Schutte & Koerting Co., Philadelphia, Pa.

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Steel Improvement & Forge Co., Cleveland, O.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GATE, BRASS AND BRONZE

American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Belknap Mfg. Co., Bridgeport, Conn.
Bordo Co., Inc., L. J., Glenside, Pa.
Capitol Brass Works, Div. of Bohn Aluminum Brass Corp., Detroit, Mich.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Phoenix Brass Fittings Corp., Irvington, N. J.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Rockford Brass Works, Rockford, Ill.
Scott Valve Mfg. Co., Detroit, Mich.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, IRON BODY

Berger Bros. Co., Philadelphia, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Eclipse Fuel Engineering Co., Rockford, Ill.
Eddy Valve Co., Waterford, N. Y.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Illinois Malleable Iron Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Co., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc. Reading, Pa.
R-S Products Corp., Philadelphia, Pa.
Rensselaer Valve Co., Cohoes, N. Y.
Scott Valve Mfg. Co., Detroit, Mich.
Semet-Solvay Engineering Corp., New York, N. Y.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GATE, STEEL

Alloy Steel Products Co., Linden, N. J.
American Hard Rubber Co., New York, N. Y.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Brass Mfg. Co., Cleveland, O.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Everlasting Valve Co., Jersey City, N. J.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
●Jenkins Bros., New York, N. Y.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

VALVES, GLOBE, BRASS AND BRONZE

American Brass Co., Waterbury, Conn.
American Injector Co., Detroit, Mich.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Fairbanks Co., New York, N. Y.
●Grinnell Co., Inc., Providence, R. I.
Hammond Brass Wks., Hammond, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Milwaukee Valve Co., Milwaukee, Wis.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Rockford Brass Works, Rockford, Ill.
Stockham Pipe Fittings Co., Birmingham, Ala.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
●Watson-Stillman Co., Roselle, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, IRON BODY

Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McAlear Mfg. Co., Chicago, Ill.
Ohio Injector Co., Wadsworth, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Shank Co., Cyrus, Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, GLOBE, STEEL

Alloy Steel Products Co., Linden, N. J.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Belfield Co., H., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Clees Valve & Engineering Co., New York, N. Y.
Colonial Alloys Co., Metals Div., Philadelphia, Pa. (stainless)
●Crane Co., Chicago, Ill.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Hasco Valve & Machine Co., Milwaukee, Wis.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
●McAlear Mfg. Co., Chicago, Ill.
Ostlind Valve, Inc., Portland, Ore.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.

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VALVES, LINED

American Hard Rubber Co., New York, N. Y. (Hard rubber lined)
Bordo Co., Inc., L. J., Glenside, Pa. (Lead, copper, tin, etc.)
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Goodrich Co., B. F., Akron, O. (Rubber lined)
Hasco Valve & Machine Co., Milwaukee, Wis. (Rubber)
●Jenkins Bros., New York, N. Y.
Lead Lined Iron Pipe Co., Wakefield, Mass. (Lead or tin)
National Lead Co., New York, N. Y. (Lead)
Northern Indiana Brass Co., Elkhart, Ind. (Tinned)
Resisto Pipe & Valve Co., East Cambridge, Mass. (Lead)
Schutte & Koerting Co., Philadelphia, Pa. (Lead)

VALVES, MIXING, STEAM AND WATER

●Bell & Gossett Co., Chicago, Ill.
Boiler Room Equipment, Inc., New York, N. Y.
Central Brass Mfg. Co., Cleveland, O.
Cooper Co., Clark, Philadelphia, Pa.
●Dole Valve Co., The, Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
●Johnson Service Co., Milwaukee, Wis.
Klipfel Mfg. Co., Chicago, Ill.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
Leonard Valve Co., Providence, R. I.
Parker Appliance Co., Cleveland, O.
Powers Regulator Co., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling, Inc., Milwaukee, Wis.
Thermo-Mix, Inc., Long Island City, N. Y. (Thermostatic mixing valve for hot and cold water)
Vapor Car Heating Co., Inc., Chicago, Ill.
Walworth Co., New York, N. Y.

VALVES, MOTOR OPERATED

Armstrong Heat Control Co., Portland, Ore.
Au-Temp-Co Corp., New York, N. Y.
Automatic Temperature Control Co., Inc., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
●Bell & Gossett Co., Chicago, Ill.
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Cutler-Hammer, Inc., Milwaukee, Wis.
Darling Valve & Mfg. Co., Williamsport, Pa.
Davis Regulator Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fairbanks Co., New York, N. Y.
Foxboro Co., Foxboro, Mass.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
Hasco Valve & Machine Co., Milwaukee, Wis.
Herske & Timmis, Inc., New York, N. Y.
Homestead Valve Mfg. Co., Coraopolis, Pa.
●Illinois Engineering Co., Chicago, Ill.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Ludlow Valve Mfg. Co., Troy, N. Y.
Lunkenheimer Co., Cincinnati, O.
Mason-Neilan Regulator Co., Boston, Mass.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
North American Mfg. Co., Cleveland, O.
Perfex Corp. (Control Div.), Milwaukee, Wis.
Powell Co., Wm., Cincinnati, O.
R-S Products Corp., Philadelphia, Pa.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Trerice Co., H. O., Detroit, Mich.
Vapor Car Heating Co., Inc., Chicago, Ill.
Vogt Machine Co., Henry, Louisville, Ky.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, NEEDLE

Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
●Maid-O-Mist, Inc., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Shank Co., Cyrus, Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Walworth Co., New York, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PLUG

Alten's Foundry & Machine Works, Lancaster, O.
Barrett, Haentjens & Co., Hazleton, Pa.
Barrett Machine Co., N. S., Pittsburgh, Pa.
Bordo Co., Inc., L. J., Glenside, Pa.
Central Valve Mfg. Co., Chicago, Ill.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
●Crane Co., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
Everlasting Valve Co., Jersey City, N. J.
●Fairbanks Co., New York, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Hasco Valve & Machine Co., Milwaukee, Wis.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Inner-Tite Clamp Corp., Elizabeth, N. J.
●Jenkins Bros., New York, N. Y.
Klingerit, Inc., New York, N. Y.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Merco Nordstrom Valve Co., Pittsburgh, Pa. (Lubricated)
Mueller Co., Decatur, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Injector Co., Wadsworth, O.
Parker Appliance Co., Cleveland, O.
Pittsburgh Brass Mfg. Co., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Stockham Pipe Fittings Co., Birmingham, Ala.
Walworth Co., New York, N. Y.
White Flo-Matic Corp., Hoosick Falls, N. Y.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, PRESSURE REDUCING AND REGULATING

●American District Steam Co., North Tonawanda, N. Y.
American Injector Co., Detroit, Mich.
Atlas Valve Co., Inc., Newark, N. J.
Bailey Meter Co., Cleveland, O.
Belfield Co., H., Philadelphia, Pa.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Central Brass Mfg. Co., Cleveland, O.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
Clees Valve & Engineering Co., New York, N. Y.
Cooper Co., Clark, Philadelphia, Pa.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
Defender Automatic Regulator Co., St. Louis, Mo.
●Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford, Ill.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Grove Regulator Co., Oakland, Cal.
Hagan Corp., Pittsburgh, Pa.
Hubbell Corp., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Keckley Co., O. C., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Leslie Co., Lyndhurst, N. J.
Locke Regulator Co., Salem, Mass.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Modern Engineering Co., St. Louis, Mo.
Monmouth Products Co., Cleveland, O.
Mueller Co., Decatur, Ill.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Northern Equipment Co., Erie, Pa.
Powers Regulator Co., Chicago, Ill.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Republic Flow Meters Co., Chicago, Ill.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.

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Schade Valve Mfg. Co., Philadelphia, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Shallcross Controls, Inc., Milwaukee, Wis.
●Spence Engineering Co., Inc., Walden, N. Y.
Squires Co., C. E., Cleveland, O.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Stickle Steam Specialties Co., Indianapolis, Ind.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
Swartwout Co., Cleveland, O.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.
Tallmadge & Co., Webster, East Orange, N. J.
●Taylor Instrument Companies, Rochester, N. Y.
Thrush & Co., H. A., Peru, Ind.
Trerice Co., H. O., Detroit, Mich.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Vapor Car Heating Co., Inc., Chicago, Ill.
Watson & McDaniel Co., Philadelphia, Pa.
Watts Regulator Co., Lawrence, Mass.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.
White Flo-Matic Corp., Hoosick Falls, N. Y.

VALVES, RADIATOR, AIR

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Anderson Products, Inc., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
●Burnham Boiler Corp., Irvington, N. Y.
Chase Brass & Copper Co., Inc., Waterbury, Conn.
Chicago Specialty Mfg. Co., Chicago, Ill.
●Crane Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●Dole Valve Co., The, Chicago, Ill.
Gorton Heating Corp., Cranford, N. J.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Keeney Mfg. Co., Newington, Conn.
Little Mfg. Co., M. S., Hartford, Conn.
Logan Electric Specialty Mfg. Co., Chicago, Ill.
●Maid-O-Mist, Inc., Chicago, Ill. (Humidifying)
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Monash-Younker Co., Chicago, Ill.
National Metal Products Corp., Chicago, Ill.
New York Air Valve Corp., New York, N. Y.
Ohio Brass Co., Mansfield, O.
Russell & Co., W. A., Bridgeport, Conn.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Slater Mfg. Co., Wakefield, Mass.
Sullivan Valve & Engineering Co., Butte, Mont.
Vapor Specialty Co., New York, N. Y.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, ELECTRIC

Au-Temp-Co Corp., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Fulton Sylphon Co., Knoxville, Tenn.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
●Sarco Co., Inc., New York, N. Y.
Vapor Car Heating Co., Inc., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, PNEUMATIC

American Schaeffer & Budenburg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
●Johnson Service Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.

VALVES, RADIATOR, AUTOMATIC TEMPERATURE CONTROL, SELF-CONTAINED

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
American Schaeffer & Budenburg Instrument Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Au-Temp-Co Corp., New York, N. Y.
Clees Valve & Engineering Co., New York, N. Y.
Edison, Inc., Thos. A., Edison Electrical Controls Div., West Orange, N. J.
Fulton Sylphon Co., Knoxville, Tenn.
Herske & Timmis, Inc., New York, N. Y.
Lawler Automatic Controls, Inc., Mount Vernon, N. Y.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Powers Regulator Co., Chicago, Ill.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, RADIATOR, ORIFICE

●American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Inc., Boston, Mass.
●Bell & Gossett Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Grinnell Co., Inc., Providence, R. I.
Haines & Co., William S., Philadelphia, Pa.
Herske & Timmis, Inc., New York, N. Y.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
New York Air Valve Corp., New York, N. Y.
●Sarco Co., Inc., New York, N. Y.
●Trane Co., La Crosse, Wis.
Walker & Eder, Inc., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.

VALVES, RADIATOR, STEAM AND HOT WATER, HAND

American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Belfield Co., H., Philadelphia, Pa.
Belknap Mfg. Co., Bridgeport, Conn.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Burnham Boiler Corp., Irvington, N. Y.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Detroit Brass & Malleable Wks., Detroit, Mich.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
●Fairbanks Co., New York, N. Y.
Gorton Heating Corp., Cranford, N. J.
●Grinnell Co., Inc., Providence, R. I.
Haines & Co., William S., Philadelphia, Pa.
Hammond Brass Wks., Hammond, Ind.
●Hoffman Specialty Co., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Jenkins Bros., New York, N. Y.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Lunkenheimer Co., Cincinnati, O.
Marsh Corp., Jas. P., Chicago, Ill.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monash-Younker Co., Chicago, Ill.
Northern Indiana Brass Co., Elkhart, Ind.
Ohio Brass Co., Mansfield, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Powell Co., Wm., Cincinnati, O.
Rockford Brass Works, Rockford, Ill.
●Sarco Co., Inc., New York, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Sterling, Inc., Milwaukee, Wis.
Stickle Steam Specialties Co., Indianapolis, Ind.
●Trane Co., La Crosse, Wis.
Walworth Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Williams Valve Co., D. T., Cincinnati, O.

VALVES, RADIATOR, STEAM AND HOT WATER, MODULATING

●American District Steam Co., North Tonawanda, N. Y.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.
Barnes & Jones, Inc., Boston, Mass.
Belknap Mfg. Co., Bridgeport, Conn.
●Bishop & Babcock Mfg. Co., Cleveland, O.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Cashin Co., W. D., Boston, Mass.
Commonwealth Brass Corp., Detroit, Mich.
●Crane Co., Chicago, Ill.
Cryer Trap & Valve Co., Inc., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
●Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corp., Cranford, N. J.
Haines & Co., William S., Philadelphia, Pa.
●Hoffman Specialty Co., Inc., Waterbury, Conn.
●Illinois Engineering Co., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
●McAlear Mfg. Co., Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Monash-Younker Co., Chicago, Ill.
Mouat Vapor Heating Co., The, Cleveland, O.
Ohio Brass Co., Mansfield, O.
Ohio Pattern Wks. & Fdry. Co., Eureka Valve Div., Cincinnati, O.
Pierce Butler Radiator Corp., Syracuse, N. Y.
●Sarco Co., Inc., New York, N. Y.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling, Inc., Milwaukee, Wis.
Tallmadge & Co., Webster, East Orange, N. J.
●Trane Co., La Crosse, Wis.
Vapor Specialty Co., New York, N. Y.
●Webster & Co., Warren, Camden, N. J.
Webster Tallmadge & Co., East Orange, N. J.

VALVES, REFRIGERATION (ANGLE, CHECK, GATE, GLOBE, NEEDLE, RELIEF)

Ashton Valve Co., Cambridge, Mass.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Belknap Mfg. Co., Bridgeport, Conn.

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●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Central Brass Mfg. Co., Cleveland, O.
●Crane Co., Chicago, Ill.
Cyrus Shank Co., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●Henry Valve Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Kerotest Mfg. Co., Pittsburgh, Pa.
Mueller Brass Co., Port Huron, Mich.
●Peerless of America, Inc., Chicago, Ill.
Pierce Butler Radiator Corp., Syracuse, N. Y.
Schaub Engineering Co., Fred H., Chicago, Ill.
Shank Co., Cyrus, Chicago, Ill.
Superior Valve and Fittings Co., Pittsburgh, Pa.
Triumph Ice Machine Co., Cincinnati, O.
●Vilter Mfg. Co., Milwaukee, Wis.
Vogt Machine Co., Henry, Louisville, Ky.
Voss, Inc., J. H. H., New York, N. Y.
Walworth Co., New York, N. Y.
Weatherhead Co., Cleveland, O.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, BACK PRESSURE

●Alco Valve Co., St. Louis, Mo.
●Baker Ice Machine Co., Inc., Omaha, Neb.
Burrows Mfg. Co., F. A., York, Pa.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, EXPANSION, CONSTANT PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Baker Ice Machine Co., Inc., Omaha, Neb.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Consolidated Safety Valve Div., Manning, Maxwell & Moore Inc., Bridgeport, Conn.
●Detroit Lubricator Co., Detroit, Mich.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Foster Engineering Co., Newark, N. J.
Fulton Sylphon Co., Knoxville, Tenn.
Hubbell Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
Mueller Brass Co., Port Huron, Mich.
●Peerless of America, Inc., Chicago, Ill.
Triumph Ice Machine Co., Cincinnati, O.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, EXPANSION, THERMOSTATIC

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Automatic Products Co., Milwaukee, Wis.
●Detroit Lubricator Co., Detroit, Mich.
●Fedders Mfg. Co., Inc., Buffalo, N. Y.
Larkin Coils, Inc., Atlanta, Ga.
Mayson Mfg. Co., Inc., Detroit, Mich.
Mueller Brass Co., Port Huron, Mich.
●Peerless of America, Inc., Chicago, Ill.
●Spoehrer-Lange Co., St. Louis, Mo.
Torrey Refrigeration Products, Los Angeles, Cal.
Voss Co., J. H. H., New York, N. Y.
X L Refrigerating Co., Chicago, Ill.

VALVES, REFRIGERATION, FLOAT, HIGH PRESSURE

●Alco Valve Co., St. Louis, Mo.
American Injector Co., Detroit, Mich.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
Foster Engineering Co., Newark, N. J.
●Frick Co., Waynesboro, Pa.
Hubbell Corp., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Mueller Brass Co., Port Huron, Mich.
Phillips & Co., H. A., Chicago, Ill.
Schaub Engineering Co., Fred H., Chicago, Ill.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Vilter Mfg. Co., Milwaukee, Wis.
X L Refrigerating Co., Chicago, Ill.
York Ice Machinery Corp., York, Pa.

VALVES, REFRIGERATION, MAGNETIC STOP

●Alco Valve Co., St. Louis, Mo.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
●General Controls Co., Glendale, Cal.
Hubbell Corp., Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Penn Electric Switch Co., Goshen, Ind.
Schaub Engineering Co., Fred H., Chicago, Ill.

VALVES, REFRIGERATION, WATER REGULATING, PRESSURE OR TEMPERATURE ACTUATED

●Automatic Products Co., Milwaukee, Wis.
●Cash Co., A. W., Decatur, Ill.
Cyrus Shank Co., Chicago, Ill.
Electrimatic Corp., Chicago, Ill.
Foster Engineering Co., Newark, N. J.
Mercoid Corp., Chicago, Ill.
Mueller Co., Decatur, Ill.
Mueller Brass Co., Port Huron, Mich.
Penn Electric Switch Co., Goshen, Ind.
Perfection Refrigeration Parts Co., Harvey, Ill.
Phillips & Co., H. A., Chicago, Ill.
●Sarco Co., Inc., New York, N. Y.
Shank Co., Cyrus, Chicago, Ill.
●Spence Engineering Co., Inc., Walden, N. Y.
Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

VALVES, RELIEF

Ashton Valve Co., Cambridge, Mass.
Beaton & Cadwell Mfg. Co., New Britain, Conn.
●Bell & Gossett Co., Chicago, Ill.
Boylston Steam Specialty Co., Chicago, Ill.
●Cash Co., A. W., Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Chaplin-Fulton Mfg. Co., Pittsburgh, Pa.
●Cochrane Corp., Philadelphia, Pa.
Consolidated Safety Valve Div., Manning, Maxwell & Moore Inc., Bridgeport, Conn.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Eddy Valve Co., Waterford, N. Y.
Edward Valve & Mfg. Co., Inc., East Chicago, Ind.
●Fisher Governor Co., Marshalltown, Ia.
Foster Engineering Co., Newark, N. J.
Fulflo Specialties Co., Inc., The, Blanchester, O. (Oil)
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
●Henry Valve Co., Chicago, Ill.
●Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York, N. Y.
Klipfel Mfg. Co., Chicago, Ill.
Locke Regulator Co., Salem, Mass.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
●Maid-O-Mist, Inc., Chicago, Ill.
Marsh Corp., Jas. P., Chicago, Ill.
Mason-Neilan Regulator Co., Boston, Mass.
●McAlear Mfg. Co., Chicago, Ill.
●McDonnell & Miller, Chicago, Ill.
Milwaukee Valve Co., Milwaukee, Wis.
Monarch Mfg. Wks., Inc., Philadelphia, Pa.
Mueller Co., Decatur, Ill.
Mueller Brass Co., Port Huron, Mich.
Mueller Steam Specialty Co., Inc., Long Island City, N. Y.
Norgren Co., Inc., C. A., Denver, Colo.
Parker Appliance Co., Cleveland, O.
Penberthy Injector Co., Detroit, Mich.
Powell Co., Wm., Cincinnati, O.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Ross Valve Mfg. Co., Inc., Troy, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schade Valve Mfg. Co., Philadelphia, Pa.
Spencer Thermostat Co., Attleboro, Mass.
Staples & Pfeiffer, Ltd., San Francisco, Cal.
Swartwout Co., Cleveland, O.
Thrush & Co., H. A., Peru, Ind.
Triplex Mfg. Co., Peru, Ind.
Tryco Products, Inc., Westfield, Mass.
Watson & McDaniel Co., Philadelphia, Pa.
●Watson-Stillman Co., Roselle, N. J.
Watts Regulator Co., Lawrence, Mass.
Wheeler Mfg. Co., C. H., Philadelphia, Pa.

VALVES, SAFETY

Ashton Valve Co., Cambridge, Mass.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., Detroit, Mich.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Foster Engineering Co., Newark, N. J.
J. E. Lonergan Co., Philadephia, Pa.
Lunkenheimer Co., Cincinnati, O.
●McDonnell & Miller, Chicago, Ill.
Walworth Co., New York, N. Y.

VALVES, SOLDER JOINT

American Brass Co., Waterbury, Conn.
American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

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Chase Brass & Copper Co., Inc., Waterbury, Conn.
●Crane Co., Chicago, Ill.
Darling Valve & Mfg. Co., Williamsport, Pa.
Hammond Brass Works, Hammond, Ind.
●Jenkins Bros., New York, N. Y.
Mueller Brass Co., Port Huron, Mich.
Northern Indiana Brass Co., Elkhart, Ind.
Parker Appliance Co., Cleveland, O.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Powell Co., Wm., Cincinnati, O.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Walworth Co., New York, N. Y. (Brazed)
Williams Valve Co., D. T., Cincinnati, O.

VALVES, SOLENOID

Albright Equipment Co., Pittsburgh, Pa.
●Alco Valve Co., St. Louis, Mo.
Anderson Products, Inc., Cambridge, Mass.
Au-Temp-Co Corp., New York, N. Y.
●Automatic Products Co., Milwaukee, Wis.
Automatic Switch Co., New York, N. Y.
Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.
Cooper Co., Clark, Philadelphia, Pa.
Cutler-Hammer, Inc., Milwaukee, Wis.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
Electric Valve Mfg. Co., Inc., New York, N. Y.
Electrimatic Corp., Chicago, Ill.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., Baltimore, Md.
●General Controls Co., Glendale, Cal.
General Electric Co., Schenectady, N. Y.
General Sales & Products Co., Cohoes, N. Y.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Guardian Electric Mfg. Co., Chicago, Ill.
Hubbell Corp., Chicago, Ill.
Hunt & Son, C. B., Salem, O.
●McDonnell & Miller, Chicago, Ill.
Mercoid Corp., Chicago, Ill.
Milwaukee Gas Specialty Co., Milwaukee, Wis.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.
Penn Electric Switch Co., Goshen, Ind.
Perfex Corp. (Controls Div.), Milwaukee, Wis.
Pfening Co., Fred D., Columbus, O.
R-S Products Corp., Philadelphia, Pa.
Rega Mfg. Co., Rochester, N. Y.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
●Sarco Co., Inc., New York, N. Y.
●Spoehrer-Lange Co., St. Louis, Mo.
Square D Co., Detroit, Mich.
Supreme Electric Products Corp., Rochester, N. Y.
Wheelco Instruments Co., Chicago, Ill.
White-Rodgers Electric Co., St. Louis, Mo.

VALVES, 2, 3, AND 4 WAY

●Alco Valve Co., St. Louis, Mo.
American Brass Co., Waterbury, Conn.
Barber-Colman Co., Rockford, Ill.
Belfield Co., H., Philadelphia, Pa.
Bordo Co., Inc., Glenside, Pa.
Bristol Co., Waterbury, Conn.
●Cash Co., A. W., Decatur, Ill.
●Crane Co., Chicago, Ill.
Davis Regulator Co., Chicago, Ill.
●Detroit Lubricator Co., Detroit, Mich.
●General Controls Co., Glendale, Cal.
Golden-Anderson Valve Specialty Co., Pittsburgh, Pa.
Homestead Valve Mfg. Co., Coraopolis, Pa.
Imperial Brass Mfg. Co., Chicago, Ill.
Inland Mfg. Co., Chicago, Ill.
Jarecki Mfg. Co., Erie, Pa.
●Johnson Service Co., Milwaukee, Wis.
Kerotest Mfg. Co., Pittsburgh, Pa.
Lonergan Co., J. E., Philadelphia, Pa.
Lunkenheimer Co., Cincinnati, O.
Luzerne Rubber Co., Trenton, N. J. (Hard rubber)
Merco Nordstrom Valve Co., Pittsburgh, Pa.
Mercoid Corp., Chicago, Ill.
●Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.
Mueller Brass Co., Port Huron, Mich.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Parker Appliance Co., Cleveland, O.
Penn Electric Switch Co., Goshen, Ind.
Powell Co., Wm., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.
Ruggles-Klingemann Mfg. Co., Salem, Mass.
Schutte & Koerting Co., Philadelphia, Pa.
●Spence Engineering Co., Inc., Walden, N. Y.
Strong, Carlisle & Hammond Co., The, Cleveland, O.
●Taylor Instrument Companies, Rochester, N. Y.
Walworth Co., New York, N. Y. (Lubricated plug valves)
Weatherhead Co., Cleveland, O.
Williams Valve Co., D. T., Cincinnati, O.

VANES, DUCT TURNING, PREFABRICATED

Barber-Colman Co., Rockford, Ill.
●Tuttle & Bailey, Inc., New Britain, Conn.
●Waterloo Register Co., Waterloo, Ia.

VAPOR HEATING SYSTEMS

See Systems, Heating, Vapor

VARIABLE SPEED PULLEYS

See Changers, Speed, Mechanical

V-BELT DRIVES

See Drives, V-Belt

VELOCITY REGULATORS

See Regulators, Air Velocity

VENETIAN BLINDS

See Blinds, Venetian

VENTILATORS, MUSHROOM

Aeolus Dickinson Co., Chicago, Ill.
Best Register Co., Milwaukee, Wis.
Falstrom Co., Passaic, N. J.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
Knowles Mushroom Ventilator Co., Montclair, N. J.
Mueller Furnace Co., L. J., Milwaukee, Wis.
●Tuttle & Bailey, Inc., New Britain, Conn.
Ventilating Products Co., Chicago, Ill.

VENTILATORS, ROOF, FAN

Aeolus Dickinson Co., Chicago, Ill.
●Air Controls, Inc., Cleveland, O.
Airmaster Corp., Chicago, Ill.
Allen Corp., Detroit, Mich.
American-Larson Ventilating Co., Pittsburgh, Pa.
Arex Co., Chicago, Ill.
Autovent Fan & Blower Co., Chicago, Ill.
Belanger Fan & Blower Co., Detroit, Mich.
Burt Mfg. Co., Akron, O.
Century Fan & Ventilator Co., New York, N. Y.
Chelsea Fan & Blower Co., New York, N. Y.
Clay Equipment Corp., Cedar Falls, Ia.
Davidson Hy Duty Roof Fan Co., Newton, Mass.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., New York, N. Y.
Diehl Mfg. Co., Elizabethport, N. J.
Economy Electric Mfg. Co., Chicago, Ill.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Falstrom Co., Passaic, N. J.
Fingles, Inc., W. A., Baltimore, Md.
General Regulator Corp., Chicago, Ill.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Corp., Grand Rapids, Mich.
Hirschman Co., W. F., Buffalo, N. Y.
Howes Co., S. M., Boston, Mass.
●Ilg Electric Ventilating Co., Chicago, Ill.
Industrial Sheet Metal Wks., Inc., Detroit, Mich.
●International Engineering, Inc., Dayton, O.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Johnson Fan & Blower Corp., Chicago, Ill.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
Lohman, Inc., Wm. J., New York, N. Y.
Myers Electric Co., Inc., Pittsburgh, Pa.
New York Blower Co., Chicago, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Propellair, Inc., Springfield, O.
Reed Unit-Fans, Inc., New Orleans, La.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, O.
Trade-Wind Motor Fans, Inc., Los Angeles, Cal.
Truflo Fan Co., Harmony, Pa.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Uno Ventilator Co., Cliftondale, Mass.
Utility Fan Corp., Los Angeles, Cal.
Van Noorden Co., E., Boston, Mass.
Viking Air Conditioning Corp., Cleveland, O.
Washburne & Co., E. G., New York, N. Y.
Waverly Heating Supply Co., Boston, Mass.
Western Engineering & Mfg. Co., Los Angeles, Cal.
●Wing Mfg. Co., L. J., New York, N. Y.

VENTILATORS, ROOF, GRAVITY

Accurate Mfg. Works, Chicago, Ill.
Aeolus Dickinson Co., Chicago, Ill.
●Airtherm Mfg. Co., St. Louis, Mo.
Allen Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
American-Larson Ventilating Co., Pittsburgh, Pa.
American Metal Products Co., Fort Worth, Texas.
American Sheet Metal Works, New Orleans, La.
Ames Co., W. R., San Francisco, Cal.
Anderson Mfg. Co., Des Moines, Ia.
Arex Co., Chicago, Ill.
Autoforce Ventilating System, Boston, Mass.
Berger Bros. Co., Philadelphia, Pa.
Burt Mfg. Co., Akron, O.

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Century Fan & Ventilating Co., New York, N. Y.
Chicago Metal Mfg. Co., Chicago, Ill.
Cincinnati Sheet Metal & Roofing Co., Cincinnati, O.
Clay Equipment Corp., Cedar Falls, Ia.
Day Co., The, Minneapolis, Minn.
Edwards Mfg. Co., Inc., Cincinnati, O.
Falstrom Co., Passaic, N. J.
Fingles, Inc., W. A., Baltimore, Md.
Goethel Co., Alfred C., Milwaukee, Wis.
Grand Rapids Blow Pipe & Dust Arrester Co., Grand Rapids, Mich.
Hirschmann Co., W. F., Buffalo, N. Y.
Howes Co., S. M., Charlestown, Boston, Mass.
Hudson Equipment Corp., Minneapolis, Minn.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
International Steel Co., Evansville, Ind.
Iona Ventilator Co., Inc., Philadelphia, Pa.
Iwan Brothers, South Bend, Ind.
Jamar Co., Walker, Duluth, Minn.
Jordan & Co., Paul R., Indianapolis, Ind.
Kernchen Co., Chicago, Ill.
King Ventilating Co., Owatonna, Minn.
Klauer Mfg. Co., Dubuque, Ia.
Kleenaire Corp., Stevens Point, Wis.
La Crosse Steel Roofing & Corrugating Co., La Crosse, Wis.
Lamneck Products, Inc., Middletown, O.
Lee & Son Co., Thomas, Cincinnati, O.
Leslie Welding Co., Chicago, Ill.
Levow, David, New York, N. Y.
Martin Metal Mfg. Co., Wichita, Kans.
Mellish & Murray Co., Chicago, Ill.
Merchant & Evans Co., Philadelphia, Pa.
Meyer & Bro. Co., F., Peoria, Ill.
Milcor Steel Co., Milwaukee, Wis.
Norman Sheet Metal Mfg. Co., W. F., Nevada, Mo.
Osborn Co., The, J. M. & L. A., Cleveland, O.
Patten Co., J. V., Sycamore, Ill.
Penn Ventilating Co., Philadelphia, Pa.
Pioneer Roofing & Sheet Metal Co., Muskogee, Okla.
Puhl & Hepper Mfg. Co., Inc., St. Louis, Mo.
Robertson Co., H. H., Pittsburgh, Pa.
Royal Ventilator Co., Philadelphia, Pa.
Rynicker Sheet Metal Works, Inc., Billings, Mont.
St. Paul Corrugating Co., St. Paul, Minn.
Schoedinger, F. O., Columbus, O.
Southbridge Roofing Co., Inc., Southbridge, Mass.
Southern States Iron Roofing Co., Savannah, Ga.
Swartwout Co., Cleveland, O.
Tierney Rotor Ventilator Co., Minneapolis, Minn.
Tiffin Art Metal Co., Tiffin, O.
Uno Ventilator Co., Cliftondale, Mass.
Van Noorden Co., E. Boston, Mass.
Walker Jamar Co., Duluth, Minn.
Western Engineering & Mfg. Co., Los Angeles, Cal.
Willis Mfg. Co., Galesburg, Ill.
York Corrugating Co., York, Pa.

VENTILATORS, UNIT

Johnson Fan & Blower Corp., Chicago, Ill.
Nelson Corp., Herman, Moline, Ill.
● Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Boston, Mass.
● Trane Co., La Crosse, Wis.

VIBRATION ELIMINATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VIBRATION ISOLATORS

See Bases and Pads, Vibration Isolating; Hose, Metal, for Eliminating Compressor Vibration

VISCOUS LIQUID PUMPS

See Pumps, Viscous Liquids

VISES, PIPE

American Pipe Tool Co., Chicago, Ill.
Armstrong Bros. Tool Co., Chicago, Ill.
Armstrong Mfg. Co., Bridgeport, Conn.
Beaver Pipe Tools, Inc., Warren, O. (Sawing—for tubing)
Billings & Spencer Co., Hartford, Conn.
Crown Die & Tool Co., Chicago, Ill.
Desmond-Stephen Mfg. Co., Urbana, Ill.
Erie Tool Wks., Erie, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hollands Mfg. Co., Erie, Pa.
International Nutyp Tool Co., Oswego, N. Y.
Jarecki Mfg. Co., Erie Pa.
Nye Tool & Machine Wks., The, Chicago, Ill.
Ridge Tool Co., Elyria, O.
Toledo Pipe Threading Machine Co., Toledo, O.
Trimont Mfg. Co., Roxbury, Mass.
Vanderman Mfg. Co., Willimantic, Conn.
Walworth Co., New York, N. Y.
● Williams & Co., J. H., New York, N. Y.
Yost Mfg. Co., Meadville, Pa.

VISE STANDS

See Stands, Pipe Vise

WALL THERMOSTATS

See Thermostats, Room or Wall

WARM AIR FURNACES

See Furnaces, Warm Air

WASHERS, AIR

● Air & Refrigeration Corp., New York, N. Y.
Airwasher Corp., Lansing, Mich.
American Blower Corp., Detroit, Mich.
American Foundry & Furnace Co., Bloomington, Ill.
Ames Co., W. R., San Francisco, Cal.
Atlas Heating & Ventilating Co., Ltd., San Francisco, Cal.
Ballantyne Co., Omaha, Neb.
Bayley Blower Co., Milwaukee, Wis.
Betz Air Conditioning Corp., Kansas City, Mo.
● Bishop & Babcock Mfg. Co., Cleveland, O.
Blower Application Co., Milwaukee, Wis.
Brundage Co., Kalamazoo, Mich.
● Buffalo Forge Co., Buffalo, N. Y.
● Carrier Corp., Syracuse, N. Y.
● Clarage Fan Co., Kalamazoo, Mich.
Columbus Heating & Ventilating Co., Columbus, O.
Electrovent Fan & Mfg. Co., Chicago, Ill.
Industrial Sheet Metal Works, Inc., Detroit, Mich.
King Ventilating Co., Owatonna, Minn.
Magirl Foundry & Furnace Wks., P. H., Bloomington, Ill.
McLouth Air Conditioning Corp., Lansing, Mich.
Mellish & Murray Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Niagara Blower Co., New York, N. Y.
Northern Blower Co., Cleveland, O.
Parks-Cramer Co., Fitchburg, Mass.
Phillips Cooling Tower Co., Inc., New York, N. Y.
Spray Engineering Co., Somerville, Mass.
Spray-Wheel Air Conditioners, Inc., Denver, Colo.
Strandwitz & Co., Inc., W. J., Camden, N. J.
Sturtevant Co., B. F., Boston, Mass.
Supreme Heater & Ventilating Corp., St. Louis, Mo.
Tenney Engineering, Inc., Bloomfield, N. J.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
● Trane Co., La Crosse, Wis.
● U. S. Air Conditioning Corp., Minneapolis, Minn.
Utica Radiator Corp., Utica, N. Y.
Utility Fan Corp., Los Angeles, Cal.
● Vilter Mfg. Co., Milwaukee, Wis.
Western Blower Co., Seattle, Wash.
York Ice Machinery Corp., York, Pa.

WATER CHILLERS

See Chillers, Water, for Air Conditioning and Refrigeration

WATER HEATERS

See Heaters, Water

WATER METERS

See Meters, Water

WATER TREATMENT

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
American Hydrozone Co., Inc., New York, N. Y.
American Water Softener Co., Philadelphia, Pa.
American Well Works, Aurora, Ill.
Aquatic Chemical Laboratories, Inc., New York, N. Y.
Automatic Pump & Softener Corp., Rockford, Ill.
Bird-Archer Co., New York, N. Y.
Builders Iron Foundry, Providence, R. I.
● Cochrane Corp., Philadelphia, Pa.
Continental Products Co., Euclid, O.
Dampney Co. of America, Boston, Mass.
Dearborn Chemical Co., Chicago, Ill.
Electroaire Corp., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Ferro-Nil Corp., New York, N. Y.
Filtrine Mfg. Co., Inc., Brooklyn, N. Y.
Grief, Edward C., Bogota, N. J.
Haering Co., D. W., Chicago, Ill.
Hagan Corp., Pittsburgh, Pa.
Metropolitan Refining Co., Long Island City, N. Y.
Mutual Chemical Co. of America, New York, N. Y.
National Aluminate Corp., Chicago, Ill.
North American Fibre Products Co., The, Cleveland, O.
Norwood Filtration Co., The, Florence, Mass.
Oakite Products, Inc., New York, N. Y.
Permutit Co., New York, N. Y.,
R. U. V. Engineering Corp., New York, N. Y.
Red Jacket Mfg. Co., Davenport, Ia.
Refinite Corp., Omaha, Nebr.
● Research Products Corp., Madison, Wis.
Scaife Co., Oakmont, Pa.
Solvay Sales Corp, New York, N. Y.
Uniflow Mfg. Co., Erie, Pa.
Warlo Corp., New York, N. Y.
Water Refining Co., Ft. Wayne, Ind.

WATER VAPOR REFRIGERATION

See Compressors, Refrigerating, Centrifugal; and Compressors, Refrigerating, Steam Jet

WELDERS, ARC

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Adams Mfg. Co., J. D., Indianapolis, Ind.
Air Reduction Sales Co., New York, N. Y.
● Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alter-Arc Mfg. Co., Lawton, Okla.
Bear Mfg. Co., Rock Island, Ill.
Burke Electric Co., Erie, Pa.
Commonwealth Electric Welder Mfg. Co., Philadelphia, Pa.

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Dynamic Welder Co., Chicago, Ill.
Eisler Engineering Corp., Newark, N. J.
Electric Arc Cutting & Welding Co., Newark, N. J.
Emerson Electric Mfg. Co., St. Louis, Mo.
Ergolyte Mfg. Co., Philadelphia, Pa.
Fern, Ralph, Scranton, Pa.
General Electric Co., Schenectady, N. Y.
General Equipment Co., Wichita, Kan.
Giant Grip Mfg. Co., Oshkosh, Wis.
Hammett Mfg. Co., Kansas City, Mo.
Hampton Electric Tool Co., Pittsburgh, Pa.
Harnischfeger Corp., Milwaukee, Wis.
Hobart Bros., Troy, O.
Hollup Corp., Chicago, Ill.
Ideal Commutator Dresser Co., Sycamore, Ill.
Ideal Electric & Mfg. Co., Mansfield, O.
Imperial Electric Co., Akron, O.
Lee & Son Co., K. O., Aberdeen, S. D.
Lincoln Electric Co., Cleveland, O.
Maple Valley Mfg. Co., Mapleton, Ia.
Marquette Mfg. Co., Minneapolis, Minn.
Miller Electric Mfg. Co., Inc., Appleton, Wis.
Ohio Welder Co., Middlefield, O.
Owen-Dyneto Corp., Syracuse, N. Y.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Co., Minneapolis, Minn.
Star Electric Motor Co., Bloomfield, N. J.
Trindl Products, Ltd., Chicago, Ill.
Universal Power Corp., Cleveland, O.
Welding Apparatus Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Will-Weld Mfg. Co., Inc., Omaha, Neb.
Wilson Welder & Metals Co., Inc., New York, N. Y.

WELDERS, SPOT

Acme Electric Welder Co., Huntington Park, Cal.
Agnew Electric Co., Milford, Mich.
Alphil Spot Welding Co., New York, N. Y.
Dyer Welder & Engineering Co., Kansas City, Mo.
Eisler Engineering Corp., Newark, N. J.
Electric Arc Cutting & Welding Co., Newark, N. J.
Federal Machine & Welder Co., Warren, O.
General Electric Co., Schenectady, N. Y.
Micro Products Co., Chicago, Ill.
Miller Electric Mfg. Co., Inc., Appleton, Wis.
Pier Equipment Mfg. Co., Benton Harbor, Mich.
Taylor-Hall Welding Corp., Worcester, Mass.
Taylor-Winfield Corp., Warren, O.
Thomson-Gibb Electric Welding Co., Lynn, Mass.
Universal Power Corp., Cleveland, O.
Weldex, Inc., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS, OXY-ACETYLENE

Air Reduction Sales Co., New York, N. Y.
Bastian-Blessing Co., Chicago, Ill.
Burdett Mfg. Co., Chicago, Ill.
Dockson Corp., Detroit, Mich.
Gasweld Equipment Co., Chicago, Ill.
Harris Calorific Co., The, Cleveland, O.
Imperial Brass Mfg. Co., Chicago, Ill.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.
Milburn Co., Alexander, Baltimore, Md.
Modern Engineering Co., St. Louis, Mo.
Ransome Concrete Machinery Co., Dunellen, N. J. (welding positioner)
Sight Feed Generator Co., Richmond, Ind.
Smith Welding Equipment Co., Minneapolis, Minn.
Torchweld Equipment Co., Div. of National Cylinder Gas Co., Chicago, Ill.

WELDING FUME COLLECTORS

See Collectors, Welding Fume

WELDING ROD

See Rod, Gas Welding

WELDING PIPE CLAMPS

See Clamps, Pipe, Welding

WHEELS, BLOWER

Advance Alumnium Castings Corp., Chicago, Ill.
●Air Controls, Inc., Cleveland, O.
American Blower Corp., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
●Bishop & Babcock Mfg. Co., Cleveland, O.
●Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
●Clarage Fan Co., Kalamazoo, Mich.
Economy Electric Mfg. Co., Chicago, Ill.
Hastings Air Conditioning Co., Hastings, Neb.
Jaden Mfg. Co., Inc., F., Hastings, Neb.
Janette Mfg. Co., Chicago, Ill.
●Lau Blower Co., Dayton, O.
Morrison Products, Inc., Cleveland, O.
New York Blower Co., Chicago, Ill.
Palmer's Mfg. Corp., Phoenix, Ariz.
Peerless Electric Co., Warren, O.
Schwitzer-Cummins Co., Indianapolis, Ind.
Sturtevant Co., B. F., Boston, Mass.
●Torrington Mfg. Co., Torrington, Conn.
Triangle Mfg. Co., Oshkosh, Wis.
●U. S. Air Conditioning Corp., Minneapolis, Minn.
Utility Fan Corp., Los Angeles, Cal.
Viking Air Conditioning Corp., Cleveland, O.
Western Blower Co., Seattle, Wash.

WHITE PRINT MACHINES

See Machines, Blue Print and White Print

WINDOW VENTILATOR AND FILTER UNITS

See Units, Window Ventilator and Filter

WINDOWS, HEAT INSULATING

Advance Insulating Co., Pittsburgh, Pa.
Andersen Corp., Bayport, Minn.
Chamberlin Metal Weather Strip Co., Detroit, Mich.
Detroit Steel Products Co., Detroit, Mich.
Kane Mfg. Corp., Kane, Pa.
Libbey-Owens Ford Glass Co., Toledo, O.
Russell Co., F. C., Cleveland, O.
Truscon Steel Co., Youngstown, O.

WOOD PIPE

See Pipe, Wood

WRENCHES, ADJUSTABLE

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Crescent Tool Co., Jamestown, N. Y.
Erie Tool Works, Erie, Pa.
Parker Appliance Co., Cleveland, O.
Peck, Stow & Wilcox Co., Southington, Conn.
Snap-On Tools Corp., Kenosha, Wis.
Trimont Mfg. Co., Boston, Mass.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, OPEN END

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, PIPE

Armstrong Bros. Tool Co., Chicago, Ill.
Bernz Co., Inc., Otto, Rochester, N. Y.
Billings & Spencer Co., Hartford, Conn.
Bonney Forge & Tool Works, Allentown, Pa.
Erie Tool Works, Erie, Pa.
Greene, Tweed & Co., New York, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
International Nutyp Tool Co., Oswego, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ridge Tool Co., Elyria, O.
Trimont Mfg. Co., Boston, Mass.
U. S. Hame Co., Buffalo, N. Y.
Walworth Co., New York, N. Y.

WRENCHES, RATCHET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Greene, Tweed & Co., New York, N. Y.
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, SOCKET

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Chicago Pneumatic Tool Co., New York, N. Y. (pneumatic)
Lowell Wrench Co., Worcester, Mass.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WRENCHES, TORQUE INDICATING

Automotive Maintenance Machinery Co., North Chicago, Ill.
Blackhawk Mfg. Co., Milwaukee, Wis.
Bonney Forge & Tool Works, Allentown, Pa.
Snap-On Tools Corp., Kenosha, Wis.
●Williams & Co., J. H., New York, N. Y.

WROUGHT IRON PIPE

See Pipe, Wrought Iron

WROUGHT IRON SHEETS

See Sheets, Wrought Iron

X-RAY MACHINES AND FILM

See Machines and Film, X-Ray

ZINC SHEETS

See Sheets, Zinc

ZONE CONTROLS

See Systems, Heating, Zone Control

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DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 2—TRADE NAMES

ABC—Humidifiers. American Blower Corp., Detroit, Mich.

AGP—Heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

A-P—Damper operators, regulators, relays, strainers, thermostats, valves. Automatic Products Co., Milwaukee, Wis.

ARRC—Fittings. Union Metal Wks., Inc., Chelsea, Mass.

Abrasoweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Absorbex—Insulation. Celotex Corp., The, Chicago, Ill.

Ace—Pipe, pipe and fittings, tanks, valves, pumps. American Hard Rubber Co., New York, N. Y.

Ace—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Acme—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Acousteel—Insulation. Celotex Corp., The, Chicago, Ill.

Acousti-Celotex—Insulation. Celotex Corp., The, Chicago, Ill.

Acoustilite—Insulation. Insulite Co., Minneapolis, Minn.

Acratherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Adjustiblade—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Adjusto—Packing. Keasbey & Mattison Co., Ambler, Pa.

Adsco—Conduit, heaters, joints, meters, pipe, pipe hangers and supports, pipe protectors, separators, strainers, regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Aeracool—Blades, fans, louvers and shutters, ventilators. Myers Electric Co., Inc., Pittsburgh, Pa.

Aerisweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Aero—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aero-Art—Radiation. National Radiator Co., The, Johnstown, Pa.

Aerocrat—Fans, humidifiers, washers. Ames Co., W. R., San Francisco, Cal.

Aeroplane—Roof ventilators. Jordon & Co., Paul R., Indianapolis, Ind.

Aeroplex—Fans. Bayley Blower Co., Milwaukee, Wis.

Aeropull—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Aerovalve—Ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

Afco—Fans, heaters. American Furnace Co., St. Louis, Mo.

Affco—Grilles, louvers and shutters, ventilators. American Foundry & Furnace Co., Bloomington, Ill.

Agitair—Air diffusers. Air Devices, Inc., New York, N. Y.

Air Beam—Fans. Hall Mfg. Co., Cedar Rapids, Ia.

Air Stone—Conduit. Dockstader, S. E., Washington, D. C.

Air Vane—Grilles, registers. Rock Island Register Co., Rock Island, Ill.

Air Control—Bearings, fans, heaters, unit coolers and air conditioners. Hastings Air Conditioning Co., Hastings, Neb.

Air-Acoustic—Insulation. Johns-Manville, New York, N. Y.

Air-A-Way—Ventilators. American Metal Products Co., Fort Worth, Tex.

Airblanket—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airco—Welding rod, solder, pipe cutting machines. Air Reduction Sales Co., New York, N. Y.

Air-Con—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Airco-DB—Torches, welding and cutting apparatus. Air Reduction Sales Co., New York, N. Y.

Airefiner—Water treatment. Oakite Products, Inc., New York, N. Y.

Airex—Fans, louvers and shutters, unit air conditioners. Mountain States Equipment Co., Denver, Colo.

Air-Fan—Window ventilator units. Ad-Lee Co., Inc., Chicago, Ill.

Air-flo—Louvers and shutters. Belanger Fan & Blower Co., Detroit, Mich.

Air-flo—Dampers, louvers and shutters. Air Conditioning Products Co., Detroit, Mich.

Airfoil—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Airguide—Hygrometers, thermometers. Fee and Stemwedel, Inc., Chicago, Ill.

Airheater—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Airistocrat—Fan blades, propeller fans. Torrington Mfg. Co., Torrington, Conn.

Airkem—Odor adsorbers. Airox Co., New York, N. Y.

Airline—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Airmat Arrester—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Airofelt — Insulation. Johns-Manville, New York, N. Y.

Airo-Flex—Registers. Auer Register Co., Cleveland, O.

Air-o-Line — Indicator-controllers, recorder-controllers. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Air-O-Matic—Refrigerating machines. Williams Oil-O-Matic Corp., Bloomington, Ill.

Airotherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Airotor—Centrifugal fans. Torrington Mfg. Co., Torrington, Conn.

Airplex—Air filters. Davies Air Filter Corp., New York, N. Y.

Airstat — Regulators. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airstream—Air filters. Brauer Supply Co., A. G., St. Louis, Mo.

Airstream—Blower wheels, fans. Morrison Products, Inc., Cleveland, O.

Airswitch—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Airvector—Unit heaters. Airtherm Mfg. Co., St. Louis, Mo.

Air-Vent—Fans. Airtherm Mfg. Co., St. Louis, Mo.

Airxpel—Steam traps. Wright-Austin Co., Detroit, Mich.

Akon—Water treatment. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Alco—Ventilators. Allen Corp., Detroit, Mich.

Alcoa—Angles, electrodes, sheets, tanks, tubing. Aluminum Co. of America, Pittsburgh, Pa.

Alkalex—Water treatment. Research Products Corp., Madison, Wis.

Allvent—Propeller fans. Autovent Fan & Blower Co., Chicago, Ill.

Almar—Pittsburgh lock forming machines. Ward Machinery Co., Chicago, Ill.

Alnor—Thermometers, air velocity meters. Illinois Testing Laboratories, Chicago, Ill.

Aloyco—Stainless steel fittings, nipples, pipe, tubing, unions, valves. Alloy Steel Products Co., Linden, N. J.

Aluminweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Always Reliable — Benders, cutters, leak detectors, torches, wrenches. Bernz Co., Inc., Otto, Rochester, N. Y.

Ambler—Cement. Keasbey & Mattison Co., Ambler, Pa.

Ambrac—Welding rod. American Brass Co., Waterbury, Conn.

Ambraloy—Welding rod. American Brass Co., Waterbury, Conn.

Amco—Humidifiers, humidistats, hygrometers. American Moistening Co., Providence, R. I.

Amco—Packing. Austin-Mason Co., New York, N. Y.

American—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Amirglass—Filters. Amirton Co., Elmsford, N. Y.

Ammco—Wrenches. Automotive Maintenance Machinery Co., North Chicago, Ill.

Ammonoduct—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Anaconda—Fittings, pipe, welding rod, sheets, solder, tubing, valves. American Brass Co., Waterbury, Conn.

Anchor—Insulation. Celotex Corp., The, Chicago, Ill.

Anemo-light—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Anemo-trol—Air diffusers. Anemostat Corp. of America, New York, N. Y.

Ankorite—Packing. Anchor Packing Co., Philadelphia, Pa.

Anode—Electrodes. Lincoln Electric Co., Cleveland, O.

Anti-Sweat — Insulation. Johns-Manville, New York, N. Y.

Apex—Pipe cutting and threading machines. Merrell Mfg. Co., Toledo, O.

Apex—Quadrants. Ohio Products Co., Cleveland, O.

Apex—Recorders. Uehling Instrument Co., Paterson, N. J.

Aqualator—Circulators. Triplex Mfg. Co., Peru, Ind.

Aquaseal—Cement and compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Aquazone—Humidifiers. Corozone Air Conditioning Corp., Cleveland, O.

Aqulux—Heaters. Johnson Co., S. T., Oakland, Cal.

Arc-Eng—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Arco—Boilers, eliminators, hangers, humidifiers, plates, radiation, regulators, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Arcoflame—Oil burners. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Arex-Austor—Roof ventilators. Arex Co., Chicago, Ill.

Aridifier—Separators. Logan Engineering Co., Chicago, Ill.

Arin—Louvers and shutters. Arex Co., Chicago, Ill.

Aristocrat—Registers. Auer Register Co., Cleveland, O.

Armco—Pipe, sheets. American Rolling Mill Co., The, Middletown, O.

Armorak—Insulation. Keasbey Co., Robert A., New York, N. Y.

Arrow — Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Arrowtrol—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Artic—Refrigerants. du Pont de Nemours & Co., E. I., R. & H. Chemicals Dept., Wilmington, Del.

Asbestocel—Insulation. Johns-Manville, New York, N. Y.

Asco—Valves, relays, switches. Automatic Switch Co., New York, N. Y.

Atlas—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Atticvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Autocrat—Fan blades, propeller fans. Torrington Mfg. Co., Torrington, Conn.

Auto-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Automatic—Tube cleaners. Albright Equipment Co., Pittsburgh, Pa.

Auto-Tite—Pipe couplings. Superior Railway Products Corp., Pittsburgh, Pa.

Autovent — Eliminators, humidifiers, valves. Maid-O-Mist, Inc., Chicago, Ill.

Autozone—Zone control unit. Tallmadge & Co., Webster, East Orange, N. J.

Axiflo—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Axiom—Filters. Blocksom & Co., Michigan City, Ind.

BAC—Unit heaters. Surface Combustion Corp., Toledo, O.

B. B.—Electric motors. Brown-Brockmeyer Co., Dayton, O.

BCA—Bearings. Bearings Co. of America, Lancaster, Pa.

B & C—Plates. Beaton & Corbin Mfg. Co., Southington, Conn.

B. & G.—Heaters, relays, regulators, thermostats, valves. Bell & Gossett Co., Chicago, Ill.

B/W—Controllers, cut-offs, relays, switches. Bender Warrick Corp., Birmingham, Mich.

B & W—Boilers, burners, tubing, stokers, valves. Babcock & Wilcox Co., New York, N. Y.

Badger—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Balancer—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Ball-Tank—Water heaters. American Bosch Corp., Springfield, Mass.

Bankhead—Oil burners. Johnson Co., S. T., Oakland, Cal.

Barcol—Humidistats, motors, operators, regulators, thermostats, valves. Barber-Colman Co., Rockford, Ill.

Barnes—Cutters. Erie Tool Works. Erie, Pa.

Barton-American — Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Battery—Registers. Register & Grille Mfg. Co., Inc., Brooklyn, N. Y.

Beacor—Valves. Beaton & Corbin Mfg. Co., Southington, Conn.

Bell—Cement. Keasbey & Mattison Co., Ambler, Pa.

Belt-Air—Propeller fans. Belco Exhaust Fan Mfg. Co., St. Louis, Mo.

Benco—Oil burners. Bennett Co., Omaha, Neb.

Benton—Boilers. Combination Boiler Co., Benton Harbor, Mich.

Beth-Co-Weld—Pipe. Bethlehem Steel Co., Bethlehem, Pa.

Beth-Cu-Loy—Sheets. Bethlehem Steel Co., Bethlehem, Pa.

Bettendorf—Oil burners. Micro-Westco, Inc., Bettendorf, Ia.

Big Midget—Soot blowers. Sturtevant Co., B. F., Boston, Mass.

Bildrite—Insulation. Insulite Co., Minneapolis, Minn.

Binoc—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Birm — Water treatment. Research Products Corp., Madison, Wis.

Bison—Boilers. Farrar & Trefts, Buffalo, N. Y.

Bitugloss — Lacquers and enamels. Wailes Dove-Hermiston Corp., Westfield, N. J.

Bloapco—Dust collectors. Blower Application Co., Milwaukee, Wis.

Blue Ribbon—Hangers or brackets, nipples, plates. Chicago Nipple Mfg. Co., Chicago, Ill.

Branford—Unions. Malleable Iron Fittings Co., Branford, Conn.

Brazarc—Electrodes. Universal Power Corp., Cleveland, O.

Brazo—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Breeze Spreader—Propeller fans. Victor Electric Products, Inc., Cincinnati, O.

Breezo—Fans. Buffalo Forge Co., Buffalo, N. Y.

Broomell—Eliminators, floats, heating systems, traps, valves. Vapor Specialty Co., New York, N. Y.

BTUnit—Unit heaters. Industrial Mfg. & Engineering Co., Chicago, Ill.

Bull Dog—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Bull Pup—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Burco—Welding apparatus. Burdett Mfg. Co., Chicago, Ill.

C-E—Boilers. Combustion Engineering Co., New York, N. Y.

C-H—Controllers and starters, heaters, relays, switches, valves. Cutler-Hammer, Inc., Milwaukee, Wis.

CJB—Bearings. Ahlberg Bearing Co., Chicago, Ill.

C & M—Hangers or brackets. Carty & Moore Engineering Co., Detroit, Mich.

C. N. I.—Pipe. Walworth Co., New York, N. Y.

COM—Blowers. Wing Mfg. Co., L. J., New York, N. Y.

Cadillac—Meters. Central Station Steam Co., Detroit, Mich.

Cadman—Valves. Barrett Machine Co., N. S., Pittsburgh, Pa.

Cadwell—Pressure regulators, valves. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Calicel—Insulation. Celotex Corp., The, Chicago, Ill.

Calistone—Insulation. Celotex Corp., The, Chicago, Ill.

Calktite—Cement and compounds. U. S. Stonewear Co., New York, N. Y.

Calorider—Dehumidifiers, humidifiers, unit air conditioners. Research Corp., New York, N. Y.

Cameo—Radiation. Weil-McLain Co., Chicago, Ill.

Capillary—Air washers, dehumidifiers. Air & Refrigeration Corp., New York, N. Y.

Capitol—Boilers, hangers or brackets, heaters, radiation. United States Radiator Corp., Detroit, Mich.

Capitol—Insulation. Standard Lime & Stone Co., Baltimore, Md.

Capitolaire—Unit air conditioners. United States Radiator Corp., Detroit, Mich.

Carbo-Cooler—Cooling surface. Mojonnier Bros. Co., Chicago, Ill.

Carboseal—Pipe joint cement. Carbide and Carbon Chemicals Corp., New York, N. Y.

Cascade—Unit air conditioners. Todd Air Conditioning Co., Inc., Bonner Springs, Kans.

Casey-Hedges—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Castirnarc—Electrodes. Universal Power Corp., Cleveland, O.

Catawissa—Unions, valves. Central Forging Co., Catawissa, Pa.

Causul—Valves. Lunkenheimer Co., Cincinnati, O.

Celoron—Couplings. Continental Diamond Fibre Co., Newark, Del.

Cemesto—Insulation. Celotex Corp., The, Chicago, Ill.

Center-Fired—Water heaters. American Bosch Corp., Springfield, Mass.

Centrimax—Meters. Leeds & Northrup Co., Philadelphia, Pa.

Centripac—Packing. Johns - Manville, New York, N. Y.

Centripeller—Roof ventilators. Jordan & Co., Paul R., Indianapolis, Ind.

Century—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Chaco—Cement and compounds, boiler and radiator sealing compounds. Desolvo Co., The, Pittsburgh, Pa.

Chalanger—Stokers. Link-Belt Co., Chicago, Ill.

Champion — Pipe wrenches. Greene, Tweed & Co., New York, N. Y.

Charavay—Propeller fans, unit heaters. Hartzell Propeller Fan Co., New York, N. Y.

Charm—Radiation. Thatcher Furnace Co., Newark, N. J.

Chevron — Packing. Garlock Packing Co., Palmyra, N. Y.

Chicago—Brakes. Dreis & Krump Mfg. Co., Chicago, Ill.

Chief—Packing. Keasbey & Mattison Co., Ambler, Pa.

Chieftain — Compressors. Tecumseh Products Co., Tecumseh, Mich.

Chill-Vactor—Steam jet compressors. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Chinook—Ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chinookfin—Non-ferrous heating surface. Bayley Blower Co., Milwaukee, Wis.

Chip Chaser—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Chromalox—Preheaters, unit heaters. Wiegand Co., Edwin L., Pittsburgh, Pa.

Chronoflo—Flow meters. Builders Iron Foundry, Providence, R. I.

Chronometer—Valves. Defender Automatic Regulator Co., St. Louis, Mo.

Chronotherm—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Circle T—Switches. Trumbull Electric Co., Plainville, Conn.

Circo—Louvers and Shutters. Circulators & Devices Mfg. Corp., New York, N. Y.

CirCOOLator—Fans, ventilators. Viking Air Conditioning Corp., Cleveland, O.

Clamp-A-Leak—Pipe repair clamps. Chelsea Metal Stamping Co., New York, N. Y.

Clarco—Unit heaters. Clarage Fan Co., Kalamazoo, Mich.

Clark-Sundh — Motor controls. Clark Controller Co., Cleveland, O.

Classic—Registers. Auer Register Co., Cleveland, O.

Cle-Bar—Heaters. Cleghorn Co., Boston, Mass.

Climate Changer—Unit air conditioners, unit air coolers. Trane Co., La Crosse, Wis.

Climax—Unions. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Cocheco—Belting. Williams & Son, I. B., Dover, N. H.

Coey—Cooling towers. Research Corp., New York, N. Y.

Cog-Belt—Transmission drives. Dayton Rubber Mfg. Co., Dayton, O.

Colalloy—Couplings, fittings, flanges, nipples, pipe, sheets, structural shapes, tubing, unions, valves. Colonial Alloys Co., Metals Div., Philadelphia, Pa.

Cold Stream—Unit air conditioners. Baker Ice Machine Co., Inc., Omaha, Nebr.

Columbia—Odor adsorbers. Carbide and Carbon Chemicals Corp., New York, N. Y.

Combustioneer—Stokers. Steel Products Engineering Co., Springfield, O.

Comet—Fans, unit heaters. New York Blower Co., Chicago, Ill.

Comfortrol—Effective temperature control. Friez & Sons, Julien P., Baltimore, Md.

Comfostat—Thermostats. Johnson Service Co., Milwaukee, Wis.

Compact—Radiation. Kohler Co., Kohler, Wis.

Compak—Valves. Commonwealth Brass Corp., Detroit, Mich.

Conco—Boiler cleaning compounds, water treatment. Continental Products Co., Euclid, O.

Condor—Belting, V belts, pipe. Manhattan Rubber Mfg. Div. of Raybestos Manhattan, Inc., Passaic, N. J.

Condo-Vac—Vacuum pumps. Chicago Pump Co., Chicago, Ill.

Coni-Vane—Ventilators. Allen Corp., Detroit, Mich.

Con-Tac-Tor — Switches. Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., Philadelphia, Pa.

Convectofin — Radiation. Commodore Heaters Corp., New York, N. Y.

Convector—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

Coolair—Fans. American Coolair Corp., Jacksonville, Fla.

Copaltite—Cement and compounds. National Engineering Products, Inc., Washington, D. C.

Copes—Governors, steam desuperheaters, valves. Northern Equipment Erie, Pa.

Cop-R-Loy—Steel sheets. Wheeling Corrugating Co., Wheeling, W. Va.

Cop-R-Loy—Sheets. Wheeling Steel Corp., Wheeling, W. Va.

Corkoustic — Insulation. Armstrong Cork Co., Lancaster, Pa.

Corto—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Cottrell—Dust collectors. Research Corp., New York, N. Y.

Coxe—Boilers. Combustion Engineering Co., New York, N. Y.

Crescent—Burners. Caloroil Burner Corp., Hartford, Conn.

Crescent—Unions. Star Mfg. Co., Inc., Providence, R. I.

Cromaloy—Solder. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Crown—Cement and compounds. Colebrook & Sons, Inc., W. H., Syracuse, N. Y.

Crucibleweld — Electrodes. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Cub—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Curtis—Regulators, traps, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Cycloidal—Air washers. Blower Application Co., Milwaukee, Wis.

Cyclops—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

Cyclotherm—Boilers. General Furnaces Corp., New York, N. Y.

DH—Ball bearings. Dodge Mfg. Corp., Mishawaka, Ind.

D & H — Evaporative condensers, cooling and heating surfaces, unit air conditioners. Drayer & Hanson, Inc., Los Angeles, Cal.

DV—Speed changers, v-belt drives. Dodge Mfg. Corp., Mishawaka, Ind.

Dampagrille — Grilles, registers. Knowles Mushroom Ventilator Co., Montclair, N. J.

Dart—Unions. Fairbanks Co., New York, N. Y.

Dean—Cleaners. Pierce Co., Wm. B., The, Buffalo, N. Y.

Decalorator—Steam jet compressors. Ross Heater & Mfg. Co., Inc., Buffalo, N. Y.

Deflecto—Roof ventilators. Day Co., The, Minneapolis, Minn.

Deflect-O-Grille—Grilles. U. S. Air Conditioning Corp., Minneapolis, Minn.

Detroit—Traps. Nason Co., Detroit, Mich.

Detroit LoStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Detroit Unistoker — Stokers. Detroit Stoker Co., Detroit, Mich.

Dexter—Air separators. Leavitt Machine Co., Orange, Mass.

Dexter-Goebel — Systems, regulators. National Brass Co., Grand Rapids, Mich.

Dezert Kooler—Units. Utility Fan Corp., Los Angeles, Cal.

Diamond Fibre—Gaskets. Continental Diamond Fibre Co., Newark, Del.

Diamond H — Switches, thermostats. Hart Mfg. Co., Hartford, Conn.

Difr-enshal-Vacm — Heating systems. Dunham Co., C. A., Chicago, Ill.

Directherm—Direct fired heaters. Airtherm Mfg. Co., St. Louis, Mo.

Discfin—Cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Disc-Loc—Grilles. Knowles Mushroom Ventilator Co., Montclair, N. J.

Dominion—Gaskets, packing. Darcoid Co., Inc., New York, N. Y.

Dorex—Odor adsorbers. Connor Engineering Corp., W. B., Dorex Div., New York, N. Y.

Double Diamond — Hygrometers, recorders, psychrometers. H-B Instrument Co., Philadelphia, Pa.

Double-Seal—Copper tube fittings. Hays Mfg. Co., Erie, Pa.

Downblast—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Draftite—Cement, Keasbey & Mattison Co., Ambler, Pa.

Draftrite — Gages. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Drainator — Traps. Coe Mfg. Co., Painesville, O.

Dry-paC—Insulation. Ric-wiL Co., Cleveland, O.

Dual-Clone—Dust collectors. Day Co., The, Minneapolis, Minn.

Dualsteel—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Dual-System—Hot water heating systems. General Blower Co., Inc., Philadelphia, Pa.

Duco—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Dulux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Dunco—Relays, switches, thermostats. Dunn Inc., Struthers, Philadelphia, Pa.

Duoflo—Pipe line strainers. Sheffler-Gross Co., Philadelphia, Pa.

Duo-Stat — Heating systems, thermostats. Johnson Service Co., Milwaukee, Wis.

Duotrol—Regulators. Automatic Control Co., St. Paul, Minn.

Duplex—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Duplex—Pipe cutting machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Duplex—Pipe line strainers. Maid-O-Mist, Inc., Chicago, Ill.

Duplex—Tubing. Bridgeport Brass Co., Bridgeport, Conn.

DuraBilt—Registers. Auer Register Co., Cleveland, O.

Dura-Flex—Registers. Auer Register Co., Cleveland, O.

Dura-Line—Registers. Auer Register Co., Cleveland, O.

DuraSpeed—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Durimet—Steel sheets. Duriron Co., Inc., Dayton, O.

Duroline — Pipe. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Dustrol—Dust collectors. Falstrom Co., Passaic, N. J.

Dust-Stop—Air filters. Owens-Corning Fiberglas Corp., Toledo, O.

Dustube—Dust collectors. American Foundry Equipment Co., Mishawaka, Ind.

Dux-Sulation—Insulation. Wilson, Inc., Grant, Chicago, Ill.

EC & M—Motor controls. Electric Controller & Mfg. Co., Cleveland, O.

Eafco—Fittings. Eastern Foundry Co., Boyertown, Pa.

Eastwood—Boilers, radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Easyclean—Strainers. Wright-Austin Co., Detroit, Mich.

Easy-Flo—Solder. Handy & Harman, New York, N. Y.

Easyweld—Electrodes. Universal Power Corp., Cleveland, O.

Eclipse—Governors, regulators, traps, valves. Illinois Engineering Co., Chicago, Ill.

Economy—Boilers, heaters. International Heater Co., Utica, N. Y.

Economy—Heating systems. Maid-O-Mist, Inc., Chicago, Ill.

Economy—Registers. Auer Register Co., Cleveland, O.

Economy—Regulators. Dockson Corp., Detroit, Mich.

Economy—Unit ventilators. Arex Co., Chicago, Ill.

Effleo—Louvers and shutters. Hirschman Co., W. F., Buffalo, N. Y.

Electairmeter—Anemometers. Walker and Eder, Inc., New York, N. Y.

Electo-Wind—Ventilators. Allen Corp., Detroit, Mich.

Electrifugal—Centrifugal pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Electro-Matic—Air cleaners. American Air Filter Co., Inc., Louisville, Ky.

Electromode—Electric heaters. Electric Air Heater Co., Div., American Foundry Equipment Co., Mishawaka, Ind.

Electro-Sheet—Sheets. American Brass Co., Waterbury, Conn.

Electrozone—Ozone apparatus. Automatic Pump & Softener Corp., Rockford, Ill.

Electrunite—Stainless steel tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Elite—Registers. Auer Register Co., Cleveland, O.

Embee—Cement and compounds. Montgomery Bros., San Francisco, Cal.

Emco—Regulators. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Emergency—Steam traps. Wright-Austin Co., Detroit, Mich.

Enco—Burners, regulators. Engineer Co., New York, N. Y.

Enduro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Enduro—Pipe, sheets, tubing. Steel and Tubes, Div. of Republic Steel Corp., Cleveland, O.

Enduro—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Entrained Combustion—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Equarad—Zone control radiator valve. Tallmadge & Co., Webster, East Orange, N. J.

Equatherm—Zone control thermostat. Tallmadge & Co., Webster, East Orange, N. J.

Equiflo—Valves. Grinnell Co., Inc., Providence, R. I.

Esso—Burners, heaters. Gilbert & Barker Mfg. Co., Springfield, Mass.

Eureka—Valves. Ohio Pattern Wks. & Foundry Co., Eureka Valve Div., Cincinnati, O.

Evactor—Pumps. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Evco—Valves. Electric Valve Mfg. Co., Inc., New York, N. Y.

Evenaction—Valves. Taylor Instrument Companies, Rochester, N. Y.

Evenaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Everdur—Welding rod. American Brass Co., Waterbury, Conn.

Evrtyte—Valves. Strong, Carlisle & Hammond Co., The, Cleveland, O.

Excel—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Excelso — Water heaters. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Exhaustair—Fans. New York Blower Co., Chicago, Ill.

Exidust—Dust collectors. Allen Billmyre Corp., South Norwalk, Conn.

Extra Dry Esotoo—Liquid sulphur dioxide. Virginia Smelting Co., West Norfolk, Va.

Eye-Hye—Gages. Reliance Gauge Column Co., Cleveland, O.

E-Z-ON—Damper quadrants. Gerett Corp., M. A., Milwaukee, Wis.

F & E—Stokers. Flynn & Emrich Co., Baltimore, Md.

Fabrikated—Grilles, registers. Independent Register Co., Cleveland, O.

Falcon—Heaters, preheaters. Swoboda, Inc., H. O., New Brighton, Pa.

Fan-Air—Gas burners. Mettler Co., Lee B., Los Angeles, Cal.

Fanmix—Burners. Coppus Engineering Corp., Worcester, Mass.

Fantom—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Farragut—Packing. Darcoid Co., Inc., New York, N. Y.

Favorite—Ratchet wrenches. Greene, Tweed & Co., New York, N. Y.

Featherfin—Heating and cooling surface. Wing Mfg. Co., L. J., New York, N. Y.

Featherweight—Thermostats. Magnet Switch Co., Chicago, Ill.

Featherweight—Unit heaters. Wing Mfg. Co., L. J., New York, N. Y.

Fel-Pro—Gaskets, packing. Felt Products Mfg. Co., Chicago, Ill.

Fenn's Rotary—Ventilators. Waverly Heating Supply Co., Boston, Mass.

Fero — Radiation. Burnham Boiler Corp., Irvington, N. Y.

Ferrenewo—Valves. Lunkenheimer Co., Cincinnati, O.

Ferroclad—Insulation. Truscon Steel Co., Youngstown, O.

Ferro-Therm — Insulation. American Flange & Mfg. Co., Inc., New York, N. Y.

Ferroweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Fiberglas—Insulation. Owens-Corning Fiberglas Corp., Toledo, O.

Fiberlite—Insulation. Insulite Co., Minneapolis, Minn.

Fields—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Filmflo—Deaerators. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Filteraire—Window ventilator and filter units. Davies Air Filter Corp., New York, N. Y.

Fin-Flex—Registers. Auer Register Co., Cleveland, O.

Findlay—Stokers. Bluffton Mfg. Co., The, Findlay, O.

Fin-Line—Registers. Auer Register Co., Cleveland, O.

Fire Tender—Stokers. Holcomb & Hoke Mfg.Co., Indianapolis, Ind.

Five Star—Boilers. Smith Co., Inc., H. B., The, Westfield, Mass.

Flexarc—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Flexair—Grilles, registers. Tuttle & Bailey, Inc., New Britain, Conn.

Flexcord—Drives. Gates Rubber Co., Denver, Colo.

Flexeal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Flexiwound—Gaskets. Azor Corp., Newark, N. J.

Flexodisc — Expansion joints. Croll-Reynolds Engineering Co., Inc., New York, N. Y.

Flextan—Packing. Chicago Belting Co., Chicago, Ill.

Floatrol—Switches. Automatic Control Co., St. Paul, Minn.

Flo-Klean—Filters, strainers. Cuno Engineering Corp., Meriden, Conn.

Flo-watch—Flow meters. Builders Iron Foundry, Providence, R. I.

Flualyzer—Analyzers. Engelhard, Inc., Chas., Newark, N. J.

Flush-Kleen—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Forcedraft—Unit air coolers. Fedders Mfg. Co., Inc., Buffalo, N. Y.

Force-Flo—Circulators, heaters, regulators, systems. Kehm Corp., The, Chicago, Ill.

Fordair—Compressors. Schramm, Inc., West Chester, Pa.

Forest Fleece—Insulation. Doheny Co., John J., Belmont, Mass.

Fosco—Heaters, ventilators. Schoedinger, F. O., Columbus, O.

Francke—Flexible couplings. Waldron Corp., John, New Brunswick, N. J.

Freeflo—Grilles. Trane Co., La Crosse, Wis.

Freon—Refrigerant. Kinetic Chemicals, Inc., Wilmington, Del.

Fretz—Nipples. Devlin Mfg. Co., Inc., Thos., Burlington, N. J.

Frevent—Valves. Russell & Co., W. A., Bridgeport, Conn.

Friction Fighter—Bearings. Link-Belt Co., Indianapolis, Ind.

Frigid—High pressure blowers, propeller fan blades and fans. Circulators & Devices Mfg. Corp., New York, N. Y.

Frigistat — Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Frigitower—Cooling towers. Schubert-Christy Corp., St. Louis, Mo.

Fuel Saver — Boilers. International Boiler Wks. Co., East Stroudsburg, Pa.

Fulscope — Recorders, recorder - controllers, regulators. Taylor Instrument Companies, Rochester, N. Y.

Fyr-Feeder—Stokers. American Coal Burner Co., Chicago, Ill.

G.B.C.—Circulators, shutters. General Blower Co., Inc., Philadelphia, Pa.

G-E—Condensers. General Electric Co., Air Conditioning & Commercial Refrigeration Dept., Bloomfield, N. J.

G-M—Grilles, louvers and shutters, registers. Gillian Mfg. Co., Detroit, Mich.

G-R—Unit coolers and air conditioners. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

GTD—Pipe vises and wrenches. Greenfield Tap & Die Corp., Greenfield, Mass.

Gale—Ducts, grilles, registers. Char-Gale Mfg. Co., Minneapolis, Minn.

Gast—Filters, separators. Johnson Corp., Three Rivers, Mich.

Geddes—Radiation. Fowler & Wolfe Radiator Co., Norristown, Pa.

Gemaco—Compressors. General Machinery Co., Spokane, Wash.

Gemware — Hygrometers, psychrometers, thermometers. G. M. Mfg. Co., New York, N. Y.

Genasco—Insulation, pipe joint cement and compounds. Barber Asphalt Corp., Barber, N. J.

Genuine Detroit—Gages, humidistats, operators, switches, thermostats, valves. Detroit Lubricator Co., Detroit, Mich.

Germicidal—Lamps. General Electric Co., Lamp Dept., Cleveland, O.

Geyser—Water heaters. Thatcher Furnace Co., Newark, N. J.

Gilbarco—Burners, heaters, compressors, regulators, unit air conditioners. Gilbert & Barker Mfg. Co., Springfield, Mass.

Gilt Edge—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Gimco—Insulation. General Insulating & Mfg. Co., St. Louis, Mo.

Gland-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

Globe—Ventilators. Osborn Co., The J. M. & L. A., Cleveland, O.

Gloco Red Band—Water heaters. Glore Sales Corp., Evins F., New York, N. Y.

Glowan—Gas burners. Martin, J. O. & C. U., San Francisco, Cal.

Goetzerit—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Gohi — Sheets. Newport Rolling Mill Co., Newport, Ky.

Golden Rod—Blower wheels, fans, heaters, unit air conditioners. Jaden Mfg. Co., Inc., F., Hastings, Neb.

Gothic—Radiation. Thatcher Furnace Co., Newark, N. J.

Gradustat — Regulators, thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Graylite—Insulation. Insulite Co., Minneapolis, Minn.

Greastop—Air filters. Air-Maze Corp., Cleveland, O.

Grillometer—Direct reading air velocity meters. Detroit Air Meter Co., Detroit, Mich.

Guardian—Gaskets. Garlock Packing Co., Palmyra, N. Y.

Gulf Stream—Water heaters. Marion Machine Foundry & Supply Co., Marion, Ind.

Gun-Pakt—Expansion joints. Yarnall-Waring Co., Philadelphia, Pa.

H-B—Boilers. Smith Co., H. B., Westfield, Mass.

H & C—Grilles, registers. Hart & Cooley Mfg. Co., Holland, Mich.

H-O-H—Compounds, water treatment. Haering & Co., Inc., D. W., Chicago, Ill.

H-T—Smoke alarms. Herske & Timmis, Inc., New York, N. Y.

Hairbestos—Insulation. Wilson & Co., Chicago, Ill.

Hammerkraft—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Hammer-On—Damper quadrants. Air Control Products, Inc., Muskegon, Mich.

Hammer-Set—Belts. Rawlplug Co., Inc., The, New York, N. Y.

Handy—Benders. Holsclaw Bros., Inc., Evansville, Ind.

Handy Andy—Vise stands. Western Wire Products Co., St. Louis, Mo.

Hardweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Hartman—Air conditioning units. Norwood Filtration Co., The, Florence, Mass.

Hartmann—Heaters. Montgomery Bros., San Francisco, Cal.

Haveg—Tanks. Continental Diamond Fibre Co., Newark, Del.

Hazleton—Pumps, strainers, valves. Barrett, Haentjens & Co., Hazleton, Pa.

Health-Air—Ventilator and filter units. Ad-Lee Co., Inc., Chicago, Ill.

Health-Aire—Fans, heaters, unit coolers, ventilators. Johnson Fan & Blower Co., Chicago, Ill.

Heat Breaker—Fans. Esko Mfg. Corp., Houston, Tex.

Heath—Manometers. Detroit Air Meter Co., Detroit, Mich.

Heatomat—Heaters. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Heggie-Simplex—Boilers. Lookout Boiler & Mfg. Co., Chattanooga, Tenn.

Helical—Tubing. Rome-Turney Radiator Co., Rome, N. Y.

Hensel—Welders. Maple Valley Mfg. Co., Mapleton, Ia.

Hercules—Fans. Hirschman Co., W. F., Buffalo, N. Y.

Herculoy—Welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Hevikoat—Electrodes. Universal Power Corp., Cleveland, O.

Highflex—Belting. Goodrich Co., B. F., Akron, O.

High-Temp—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hijet—Unit heaters. Nelson Corp., Herman, Moline, Ill.

Hilger—Chillers, refrigerating compresors, unit coolers, unit air conditioners, valves. XL Refrigerating Co., Inc., Chicago, Ill.

Hi-Lo—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hi-Spra — Spray nozzles. Schubert-Christy Corp., St. Louis, Mo.

Hitchings—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Hi-Temp—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Hi-Test—Pipe. Walworth Co., New York, N. Y.

Holby—Valves. Boiler Room Equipment, Inc., New York, N. Y.

Holdfast—Solder. American Brass Co., Waterbury, Conn.

Holt—Strainers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Horneblende — Caulking compounds. North American Fibre Products Co., The, Cleveland, O.

Horton—Tanks. Chicago Bridge & Iron Co., Chicago, Ill.

Hot Shot—Pumps. Yeomans Bros. Co., Chicago, Ill.

Hot Spot—Spot welders. Acme Electric Welder Co., Huntington Park, Cal.

Hovalco—Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.

Huber—Stokers. Flynn & Emrich Co., Baltimore, Md.

Humidair—Humidifiers. Skilbeck Mfg. Co., Kenosha, Wis.

Humid-Heet—Radiators. Utica Radiator Corp., Utica, N. Y.

Humidigraph — Humidity recorders. Bristol Co., Waterbury, Conn.

Humidiguide—Hygrometers. Taylor Instrument Companies, Rochester, N. Y.

Humidome—Humidifiers and unit air conditioners. Alter Co., Harry, Chicago, Ill.

Humidostat—Humidistats. Johnson Service Co., Milwaukee, Wis.

Humi-Temps—Unit air coolers. Larkin Coils, Inc., Atlanta, Ga.

Humphrey—Unit heaters. General Gas Light Co., Kalamazoo, Mich.

Hycarb—Electrodes. Universal Power Corp., Cleveland, O.

Hydra—Valves. Albright Equipment Co., Pittsburgh, Pa.

Hydramotor—Valves. General Controls Co., Glendale, Cal.

HydraStoker—Stokers. Detroit Stoker Co., Detroit, Mich.

Hydro—Recorders. Bacharach Industrial Instrument Co., Pittsburgh, Pa.

Hydro—Packing. Keasbey & Mattison Co., Ambler, Pa.

Hydro-Clone — Collectors, condensers. Faraday Engineering Co., Boston, Mass.

Hydro-Clone—Dust collectors. Sturtevant Mill Co., Boston, Mass.

Hydron—Bellows, traps. Clifford Mfg. Co., Boston, Mass.

Hydrovac—Pumps. Ames Hydrovac Corp., Brooklyn, N. Y.

Hy-Duty—Bearings, blower wheels, fans. Schwitzer-Cummins Co., Indianapolis, Ind.

Hylo—Heating systems. Webster & Co., Warren, Camden, N. J.

Hy-Temp—Cement, insulation. Keasbey & Mattison Co., Ambler, Pa.

Hy-Test—Water heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Hytherstat—Combination humidity and temperature control. Friez & Sons, Julien P., Baltimore, Md.

Hytor—Pumps. Nash Engineering Co., South Norwalk, Conn.

I-R—Ingersoll-Rand, New York, N. Y.

Ice Engine—Gas and diesel engines. Waukesha Motor Co., Waukesha, Wis.

Ice-O-Matic — Refrigerating compressors. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ideal—Blowers. Perfection Grate & Stoker Co., Springfield, Mass.

Ideal—Boilers, water heaters, valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Ideal — Ventilators. Tuttle & Bailey, Inc., New Britain, Conn.

Ideal—Traps. Nason Co., Detroit, Mich.

Impact—Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Imperial—Boilers. National Radiator Co., The, Johnstown, Pa.

IngAclad—Stainless clad sheets. Ingersoll Steel & Disc Co., Chicago, Ill.

Ins-lite—Insulation. Insulite Co., Minneapolis, Minn.

Instant—Heaters, preheaters. Johnson Corp., Three Rivers, Mich.

Instant—Water heaters. Sterling, Inc., Milwaukee, Wis.

Insulfil—Insulation. Refractory & Insulation Corp., New York, N. Y.

Insulwool—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Ionaire—Ionization apparatus. Electroaire Corp., Chicago, Ill.

Ironton—Burners. Continental Stove Corp., Ironton, O.

J F S—Speed changers and reducers. Stephens-Adamson Mfg. Co., Aurora, Ill.

J-M Ball—Foats, traps. Cryer Trap & Valve Co., Inc., New York, N. Y.

J. M. C.—Burners. Johnson Mfg. Co., Waterloo, Ia.

Janitrol—Burners, heaters, unit air conditioners. Surface Combustion Corp., Toledo, O.

Jarco—Unions. Jarecki Mfg. Co., Erie, Pa.

Jennings—Pumps, ejectors. Nash Engineering Co., South Norwalk, Conn.

Jewel—Packing. Keasbey & Mattison Co., Ambler, Pa.

John Crane—Cement and compounds. Crane Packing Co., Chicago, Ill.

Jointite — Insulation. Mundet Cork Corp., Brooklyn, N. Y.

Jones—Stokers. Riley Stoker Corp., Worcester, Mass.

Julian d'Este—Floats, governors, strainers, thermostats, valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.

Jusrite—Ducts and duct fittings. Corbman Bros., Inc., Philadelphia, Pa.

K—Fittings. Kuhns Brothers Co., Dayton, O.

K-S-V—Ventilators. Kernchen Co., Chicago, Ill.

Kabinette—Water heaters. American Bosch Corp., Springfield, Mass.

Kable Kord—Belting. Gilmer Co., L. H., Philadelphia, Pa.

Kane—Boilers, gas burners. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Karbate—Carbon pipe. National Carbon Co., Carbon Sales Div., Cleveland, O.

Kathabar — Dehumidifiers, humidifiers, unit air conditioners. Surface Combustion Corp., Toledo, O.

Kearsarge—Gaskets, packing. Johns-Manville, New York, N. Y.

Kelly—Valves. National Metal Products Corp., Chicago, Ill.

Kentucky—Sheets. Newport Rolling Mill Co., Newport, Ky.

Key-Tite—Cement and compounds. Key Co., East St. Louis, Ill.

Kidskin—Packing. Darcoid Co., Inc., New York, N. Y.

Kimsul — Insulation. Kimberly-Clark Corp., Neenah, Wis.

King-clip—Valves. Lunkenheimer Co., Cincinnati, O.

Kitchenaire—Propeller fans. Allen Corp., Detroit, Mich.

Kleen Tube—Heaters. Vapor Car Heating Co., Inc., Chicago, Ill.

Kleenflo — Unit air filters. Air-Maze Corp., Cleveland, O.

Klixon—Temperature controls. Spencer Thermostat Co., Attleboro, Mass.

Klondike—Arc welders. Fern, Ralph, Scranton, Pa.

K-Master—Strainers, traps. Kaye & Macdonald, Inc., West Orange, N. J.

Kno-Draft—Air diffusers. Plandaire, Inc., Pittsburgh, 13, Pa.

Kon-Nec-Tor—Mercury switches. General Electric Co., Lamp Dept., Cleveland, O.

Konverto—Water heaters. American Bosch Corp., Springfield, Mass.

Kool-Shade — Solar heat resisting screens. Ingersoll Steel & Disc Co., Chicago, Ill.

Kooler-Aire—Commercial air conditioners. U. S. Air Conditioning Corp., Minneapolis, Minn.

Kopp-Sure-Travel—Joints. Kopperman & Sons, Joseph, Philadelphia, Pa.

Krupp—Valves. Shank Co., Cyrus, Chicago, Ill.

Kwic-Lift—Hangers or brackets. Sterling, Inc., Milwaukee, Wis.

L. A.—Motors. Louis Allis Co., Milwaukee, Wis.

L&N—Regulators. Leeds & Northrup Co., Philadelphia, Pa.

L-R—Couplings. Lovejoy Flexible Couplings Co., Chicago, Ill.

L. R. D.—Valves. Grinnell Co., Inc., Providence, R. I.

Laddi—Heaters. Johnson Co., S. T. Oakland, Cal.

Lamino—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Lavigne—Valves. Commonwealth Brass Corp., Detroit, Mich.

Lawson—Wrenches. U. S. Hame Co., Buffalo, N. Y.

Leader—Stocks and dies. Oster Mfg. Co., Cleveland, O.

Lectrodryer—Dehumidifiers. Pittsburgh Lectrodryer Corp., Pittsburgh, Pa.

Lectro Shear—Shears. Black & Decker Mfg. Co., Towson, Md.

Ledaloyl—Sleeve bearings. Johnson Bronze Co., New Castle, Pa.

Levelometer—Gages, recorders. Liquidometer Corp., Long Island City, N. Y.

Liberty—Packing. Johns-Manville, New York, N. Y.

Lima—Stokers. Carnes, Inc., John R., Lima, O.

Limit-Load—Centrifugal fans. Buffalo Forge Co., Buffalo, N. Y.

Limpet—Insulation. Keasbey & Mattison Co., Ambler, Pa.

Linnbestos—Insulation. Celotex Corp., The, Chicago, Ill.

Linc-Weld—Motors. Lincoln Electric Co., Cleveland, O.

Lindsay Structure—Cabinet construction for air conditioning equipment. Dry-Zero Corp., Chicago, Ill.

Lipman—Compressors, cooling surface. General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.

Liquivator—Pumps. Morehead Mfg. Co., Detroit, Mich.

Little Giant—Pipe extractors, vises, stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Little Giant—Unit heaters. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Little Giant—Radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Little Giant—Switches, Tork Clock Co., Inc., Mt. Vernon, N. Y.

Lo-Blast—Burners. National Machine Wks., Chicago, Ill.

Locarb—Electrodes. Universal Power Corp., Cleveland, O.

Lockaire—Insulation. Plastergon Wall Board Co., Buffalo, N. Y.

Logan—Radiation. Logansport Radiator Equipment Co., Logansport, Ind.

Lok-Joint — Insulation. Insulite Co., Minneapolis, Minn.

Lolag—Heaters. American Instrument Co., Silver Spring, Md.

Lo-Maintenance—Motors. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Longrip—Pipe extractors. Ridge Tool Co., Elyria, O.

Lord Burnham—Boilers. Burnham Boiler Corp., Irvington, N. Y.

Lowcost—Boilers. Murray Iron Wks., Co., Burlington, Ia.

Lubricore—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Lul—Unit coolers. Merchant & Evans Co., Philadelphia, Pa.

Luminare—Electrodes. Universal Power Corp., Cleveland, O.

Lyonore—Sheets. Lyon, Conklin & Co., Inc., Baltimore, Md.

M. & E. — Refrigerating compressors. Merchant & Evans Co., Philadelphia, Pa.

M & M — Cut-offs, feeders, fittings, floats, governors, humidifiers, operators, pumps, regulators, switches, tubing, valves. McDonnell & Miller, Chicago, Ill.

M & S—Gaskets, insulation. Mitchell & Smith, Inc., Detroit, Mich.

MIF — Couplings, fittings. Malleable Iron Fittings Co., Branford, Conn.

MJL—Gages, manometers, meters, recorders. Morey & Jones, Ltd., Los Angeles, Cal.

MKO—Boiler feeders, pumps. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

M/W and A/C Airmat — Air filters. American Air Filter Co., Inc., Louisville, Ky.

Macheta—Fans, fan blades. Aerovent Fan Co., Piqua, O.

Magic-Weather — Air washers, fans, unit air coolers. Ballantyne Co., Omaha, Nebr.

Majestic — Boilers. Ames Iron Wks., Div. of Pierce Butler Radiator Corp., Oswego, N. Y.

Manganweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Mark Time—Time switches. Rhodes, Inc., M. H., Hartford, Conn.

Martell—Packing. France Packing Co., Tacony, Philadelphia, Pa.

Marvelaire—Furnaces. Essick Mfg. Co., Los Angeles, Cal.

Mascote—Insulation. Munn and Steele, Inc., Newark, N. J.

Massachusetts — Fans, unit heaters, blower wheels, air washers. Bishop & Babcock Mfg. Co., Cleveland, O.

Master—Stokers. Muncie Gear Wks., Inc., Muncie, Ind.

Master—Thermostats, regulators, switches. White Mfg. Co., St. Paul, Minn.

Master—Unions. Lockport Fittings Co., Inc., Lockport, N. Y.

Master Kraft—Oil burners, unit heaters and air conditioners. Harvey-Whipple, Inc., Springfield, Mass.

Mayflower—Refrigerating compressors. Hardy Mfg. Co., Inc., Dayton, O.

McDaniel—Floats, traps. Watson & McDaniel Co., Philadelphia, Pa.

McKee—Blowers, boilers, burners, feeders, pumps, regulators, tanks, valves, Eclipse Fuel Engineering Co., Rockford, Ill.

McKeesport — Radiation. Columbia Radiator Co., McKeesport, Pa.

McKnight—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Measurrench — Wrenches. Williams & Co., J. H., New York, N. Y.

Mechanovent—Ventilators. New York Blower Co., Chicago, Ill.

Meco—Regulators, torches, valves, welding rod. Modern Engineering Co., St. Louis, Mo.

Mellobiu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Mel-Rock—Humidifiers, units, ventilators, washers. Mellish & Murray Co., Chicago, Ill.

Menlo—Water heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Merkustat — Regulators, switches. Marsh Corp., Jas. P., Chicago, Ill.

Merrill Process — Heating systems. Parks-Cramer Co., Fitchburg, Mass.

Metal-Master—Shears. Wiss & Sons Co., J., Newark, N. J.

Metermax — Combustion control systems. Leeds & Northrup Co., Philadelphia, Pa.

Metric—Meters. American Meter Co., Inc., New York, N. Y.

Metrotherm — Thermostats. General Controls Co., Glendale, Cal.

Micarta—Bearings. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Micro—Low water cut-offs. Maid-O-Mist, Inc., Chicago, Ill.

Micromax — Recorders, recorder-controllers, thermometers. Leeds & Northrup Co., Philadelphia, Pa.

Microstat—Thermostats. Friez & Sons, Julien P., Baltimore, Md.

Midget — Radiation. Utica Radiator Corp., Utica, N. Y.

Mills—Boilers. Smith Co., Inc., H. B., The, Westfield, Mass.

Milvaco—Air eliminators, floats, heating systems, radiator orifices, strainers, traps, unions, valves. Milwaukee Valve Co., Milwaukee, Wis.

Milwaukee—Heaters. Blower Application Co., Milwaukee, Wis.

Milwaukee—Stokers. Automatic Stoker Corp., Milwaukee, Wis.

Mircle Air—Window ventilator units. Ad-Lee Co., Inc., Chicago, Ill.

Mir-O-Meter—Combustion control systems. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Mirro-Matic—Heaters. Handley Brown Heater Co., Jackson, Mich.

Mirro-Shell—Heaters. Handley Brown Heater Co., Jackson, Mich.

MKayO — Boilers. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Mobilaire—Unit air coolers. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Mobilene — Gaskets. Johns-Manville, New York, N. Y.

Moderator—Heating system. Warren Webster Co., Camden, N. J.

ModernAire—Fans, unit air conditioners. Dallas Engineering Co., Inc., Dallas, Tex.

Modustat — Valves. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Modutrol—Heating systems. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Mogul—Packing. Johns-Manville, New York, N. Y.

Mogul—Boiler cleaning compounds and water treatment. North American Fibre Products Co., The, Cleveland, O.

Mohawk—Pipe. Cohoes Rolling Mill Co., Cohoes, N. Y.

Moncrief—Sheet metal pipe and fittings. Henry Furnace & Foundry Co., Cleveland, O.

Mongol—Pipe joint cement and compounds. Baer Bros., New York, N. Y.

Mono-Cast—Pipe. American Cast Iron Pipe Co., Birmingham, Ala.

Monsoon—Fans, grilles, louvers. Jamieson Mfg. Co., Dallas, Tex.

Morflex — Flexible couplings. Morse Chain Co., Ithaca, N. Y.

Mortex—Insulation. Mortell Co., J. W., Chicago, Ill.

Mosher—Separators. Barrett Machine Co., N. S., Pittsburgh, Pa.

Motoco — Recorders, thermometers. Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., La Crosse, Wis.

Moto-Merco—Relays. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Motopump—Pumps. Yeomans Bros. Co., Chicago, Ill.

Motorstoker—Stokers. Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.

Mototurb—Ventilators. Uno Ventilator Co., Cliftondale, Mass.

Muffletone—Insulation. Celotex Corp., The, Chicago, Ill.

Multiclone—Dust collectors. Western Precipitation Corp., Los Angeles, Cal.

Multiclones—Dust collectors. Research Corp., New York, N. Y.

Multifin—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Multiflex—Valves. Wheeler Mfg. Co., C. H., Philadelphia, Pa.

Multi-Panel—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Multiseal—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Multitherm—Air conditioning units. Clarage Fan Co., Kalamazoo, Mich.

Multivane—Fans, blowers, unit heaters. B. F. Sturtevant Co., Boston, Mass.

Multi-Wash—Dust collectors. Schneible Co., Claude B., Chicago, Ill.

Murex—Welding electrodes. Metal & Thermit Corp., New York, N. Y.

Murray—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

N-M-D — Valves. Lunkenheimer Co., Cincinnati, O.

NYBCo Steelfin—Heating surface. New York Blower Co., Chicago, Ill.

National—Compressors. Janette Mfg. Co., Chicago, Ill.

National—Pumps. Austin-Mason Co., New York, N. Y.

Naturzone—Insulation. Wilson & Co., Chicago, Ill.

Nelson—Stokers. Heating Assurance, Inc., Spokane, Wash.

Nemo—Insulating cement. Smith & Kanzler, Inc., Elizabeth, N. J.

New Cyclone—Dust collectors. Kirk & Blum Mfg. Co., Cincinnati, O.

New Kathode — Electrodes. Lincoln Electric Co., Cleveland, O.

New Lightweld — Electrodes. Lincoln Electric Co., Cleveland, O.

Niagara—Meters, strainers. Buffalo Meter Co., Buffalo, N. Y.

Nibco—Fittings, heads, joints, nozzles, valves. Northern Indiana Brass Co., Elkhart, Ind.

Ni-Resist—Pipe. Walworth Co., New York, N. Y.

No-Grip—Shears. Wiss & Sons Co., J., Newark, N. J.

Non-clog—Sewage ejectors. Chicago Pump Co., Chicago, Ill.

Non-Clog—Pipe line strainers. Boylston Steam Specialty Co., Chicago, Ill.

Non-Con-Dux—Cement, insulation. Wilson, Inc., Grant, Chicago, Ill.

Non-Flash—Brazing torches, welding and cutting apparatus. Torchweld Equipment Co., Chicago, Ill.

Non-Frost — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Non-Sweat — Insulation. Keasbey & Mattison Co., Ambler, Pa.

Norblo—Dust collectors, fans, washers. Northern Blower Co., Cleveland, O.

Nordstrom—Valves. Merco-Nordstrom Valve Co., Pittsburgh, Pa.

Northwind—Unit air coolers. Pleasantaire Corp., Washington, D. C.

Norwesco—Cement and compounds, boiler and radiator sealing compounds. Atlas Chemical Co., Marietta, O.

No Streak—Registers. Rock Island Register Co., Rock Island, Ill.

No-Tank—Water heaters. American Bosch Corp., Springfield, Mass.

No-Thread—Fittings. Dresser Mfg. Co., Bradford, Pa.

No-Ve-U—Door ventilators. Waterloo Register Co., Waterloo, Ia.

Novoid—Insulation. Cork Import Corp., New York, N. Y.

Novus—Boilers. National Radiator Co., The, Johnstown, Pa.

Nu-Air—Air conditioning units. American Metal Products Co., Fort Worth, Texas.

Nu-Air—Fans. Meier Electric & Machine Co., Indianapolis, Ind.

Nu-Air—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Alpina—Ventilators. Milcor Steel Co., Milwaukee, Wis.

Nu-Notch — Mushroom ventilators. Knowles Mushroom Ventilator Co., Montclair, N. J.

OB—Valves, unions. Ohio Brass Co., Mansfield, O.

O.E.F.—Preheaters, water heaters. Frank Heaters, Inc., Paterson, N. J.

OK—Motors. Marathon Electric Mfg. Corp., Wausau, Wis.

OK—Stocks and dies. Greenfield Tap & Die Corp., Greenfield, Mass.

Ofeldt—Boilers, superheaters. Mears-Kane-Ofeldt, Inc., Philadelphia, Pa.

Oil-O-Matic — Oil burners. Williams Oil-O-Matic Heating Corp., Bloomington, Ill.

Ol' Faithful—Humidifiers. Maid-O-Mist, Inc., Chicago, Ill.

Oriflex—Valves. Dunham Co., C. A., Chicago, Ill.

Oswego—Cutters, punches, wrenches. International Nutyp Tool Co., Oswego, N. Y.

Ovaltube—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Oxford—Unions. Standard Union Co., New York, N. Y.

Oxweld—Welding rod, welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

PDQC — Pipe machines. Bignall & Keeler Machine Wks., Edwardsville, Ill.

P & H—Welding electrodes. Harnischfeger Corp., Milwaukee, Wis.

P & H—Hansen—Arc Welders. Harnischfeger Corp., Milwaukee, Wis.

P. I. V.—Speed changers. Link-Belt Co., Philadelphia, Pa.

Packaged Steam—Boilers. PS Inc., Los Angeles, Cal.

Paintgrip — Sheets. American Rolling Mill Co., The, Middletown, O.

Palco—Packing. Greene, Tweed & Co., New York, N. Y.

Palco Wool—Insulation. Pacific Lumber Co., The, San Francisco, Cal.

Palmetto—Packing. Greene, Tweed & Co., New York, N. Y.

Par—Condensing units. Modern Equipment Corp., Defiance, O.

Paracoil — Heaters, preheaters. Davis Engineering Corp., Elizabeth, N. J.

Paraline—Motor bases. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Parko—Psychrometers. Parks-Cramer Co., Fitchburg, Mass.

Pebble—Registers. Auer Register Co., Cleveland, O.

Pebco—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Peer—Welders. Pier Equipment Mfg. Co., Benton Harbor, Mich.

Peerless—Dust collectors, humidifiers, air washers. New York Blower Co., Chicago, Ill.

Peerless—Pipe machines. Bignall & Keeler Machine Works, Edwardsville, Ill.

Penn-M-Co—Fittings. Penn Mfg. Corp. of Washington, Pa., Washington, Pa.

Perfection—Plates. Beaton & Cadwell Mfg. Co., New Britain, Conn.

Perfection—Regulators, valves. American District Steam Co., North Tonawanda, N. Y.

Permalined—Pipe. Jones & Laughlin Steel Corp., Pittsburgh, Pa.

Permanite—Packing. Keasbey & Mattison Co., Ambler, Pa.

Permat—Filters. Davies Air Filter Corp., New York, N. Y.

Petro—Oil burners. Petroleum Heat & Power Co., Stamford, Conn.

Pexto — Brakes, punches, shears, wrenches. Peck, Stow & Wilcox Co., Southington, Conn.

Pipe Master—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Pipemaster—Wrenches. Erie Tool Wks., Erie, Pa.

Pitco—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Pittsburgh—Unit heaters. Automatic Gas Equipment Co., Pittsburgh, Pa.

Plasgon—Cement and compounds. Cabot, Inc., Samuel, Boston, Mass.

Plasti-Calk —Caulking compounds. Chamberlin Metal Weather Strip Co., Detroit, Mich.

Plastiseal — Cement and Compounds. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Plastoid—Caulking compounds. Plastic Products Co., Detroit, Mich.

Playford—Stokers. Rosedale Foundry & Machine Co., Pittsburgh, Pa.

Plexifin—Unit heaters. Bayley Blower Co., Milwaukee, Wis.

Plexiform—Fans. Bayley Blower Co., Milwaukee, Wis.

Plumrite—Pipe. Bridgeport Brass Co., Bridgeport, Conn.

Plymco—Air filters. Plymouth Cordage Co., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass. National Sales Agents.

Plymouth—Stokers. Clizbe Bros. Mfg. Co., Plymouth, Ind.

Polartron—Relays, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Popular—Boilers. Pierce Butler Radiator Corp., Syracuse, N. Y.

Porto-Power—Pipe benders. Blackhawk Mfg. Co., Milwaukee, Wis.

Pottsco—Insulation. Celotex Corp., The, Chicago, Ill.

Power—Belting. Rhoads & Sons, J. E. Philadelphia, Pa.

Power Boy—Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Power-Flex—Stokers. Link-Belt Co., Chicago, Ill.

Power Pak—Boilers. Orr & Sembower, Inc., Reading, Pa.

Precipitron — Air cleaners. Westinghouse Electric & Mfg. Co., Cleveland, O.

Premier—Boilers. Combustion Engineering Co., Inc., New York, N. Y.

Premier — Boilers, heaters. National Radiator, Co., The, Johnstown, Pa.

Premier—Welding rod. American Steel & Wire Co., Cleveland, O.

Presstico—Insulation. Presstite Engineering Co., St. Louis, Mo.

Pressuretrol — Regulators, switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Prest-O-Lite—Leak detectors, torches. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Prest-O-Weld — Welding and cutting apparatus. Linde Air Products Co., The, New York, N. Y.

Princo—Anemometers, gages, hygrometers, manometers, psychrometers, regulators, relays, thermometers, thermostats. Precision Thermometer & Instrument Co., Philadelphia, Pa.

Probestos—Gasket. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectomotor—Air filters. Staynew Filter Corp., Rochester, N. Y.

Protectorelay — Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Protectoring—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Protectovent—Window ventilator and filter units. Staynew Filter Corp., Rochester, N. Y.

Pulling—Circulators, pumps. Columbus Steam Pump Works Co., Columbus, O.

Pulverzone—Stokers. American Coal Burner Co., Chicago, Ill.

Punkah—Louvers and shutters. Kelvin-White Co., Boston, Mass.

Pureco—Refrigerants. Pure Carbonic, Inc., New York, N. Y.

Purox—Electrodes, welding and cutting apparatus. Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., New York, N. Y.

Pyralux—Enamels and lacquers. du Pont de Nemours & Co. (Inc.), E. I., Fabrics & Finishes Dept., Wilmington, Del.

Pyrex—Glass pipe. Corning Glass Wks., Corning, N. Y.

Pyro—Thermometers, recorders, regulators. Pyrometer Instrument Co., New York, N. Y.

Pyroment—Cement. Keasbey & Mattison Co., Ambler, Pa.

Q. F. R.—Pipe, tubing. Wheatland Tube Co., Philadelphia, Pa.

Q-T—Insulation. Celotex Corp., The, Chicago, Ill.

QT—Unit heaters. Kisco Boiler & Engineering Co., St. Louis, Mo.

Quartzoid—Sprinkler heads. Grinnell Co., Inc., Providence, R. I.

Quiet Zone—Blower wheels, fans. Palmer's Mfg. Corp., Phoenix, Ariz.

Quintuplet—Valves. Maid-O-Mist, Inc., Chicago, Ill.

RBC—Roller bearings. Roller Bearing Co. of America, Trenton, N. J.

RB Pressure—Pressure blowers. Western Blower Co., Seattle, Wash.

R & G—Grilles, registers. Register & Grille Mfg. Co., Brooklyn, N. Y.

R-K—Combustion control systems, regulators, valves. Ruggles-Klingemann Mfg. Co., Salem, Mass.

R & M—Motors. Robbins & Myers, Inc., Springfield, O.

R & M Moyno—Pumps. Robbins & Myers, Inc., Springfield, O.

R-P Zeolite—Water treatment. Research Products Corp., Madison, Wis.

R. P. & C.—Valves. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport, Conn.

R-U-F—Fans. Reed Unit-Fans, Inc., New Orleans, La.

Racine—Time switches. Reliance Automatic Lighting Co., Racine, Wis.

Radialflow—Valves. Smolensky Valve Co., Inc., Cleveland, O.

Radiant-Vector — Radiation. Pierce Butler Radiator Corp., Syracuse, N. Y.

Radiatherm—Valves. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Radi-Ion—Ionization apparatus. Montgomery Bros., San Francisco, Cal.

Radolite—Cement. Pyrolite Products Co., Cleveland, O.

Rainbow Mist — Nozzles. Peterson Freezem Mfg. & Sales Co., Kansas City, Mo.

Rajah—Packing. Johns-Manville, New York, N. Y.

Rapiduction—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Rawl-Anchor—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Rawls—Bolts. Rawlplug Co., Inc., The, New York, N. Y.

Raybould — Couplings. Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

Raydiant—Radiation. Weil-McLain Co., Chicago, Ill.

Reco—Air conditioning units. Refrigeration Economics Co., Inc., Canton, O.

Reco—Accumulators, condensers, headers, heaters, preheaters, tanks, unit coolers. Richmond Engineering Co., Richmond, Va.

Reco—Motors. Reynolds Electric Co., Chicago, Ill.

Record-O-Stat — Recorder - Controllers. Johnson Service Co., Milwaukee, Wis.

Recoy—Chillers, condensers, cooling surface, unit coolers. Refrigeration Economics Co., Inc., Canton, O.

Red—Operators, regulators, switches, valves. Cooper Co., Clark, Philadelphia, Pa.

Red Band—Motors. Howell Electric Motors Co., Howell, Mich.

Red Devil—Cement. Pecora Paint Co., Philadelphia, Pa.

Red Diamond—Conduit, pipe. American District Steam Co., North Tonawanda, N. Y.

Red Dome—Heaters. Smith Co., Inc., H. B., The, Westfield, Mass.

Red Flash—Traps. Ellis Drier Co., Chicago, Ill.

Red Head—Tongs. Billings & Spencer Co., Hartford, Conn.

Red Head—Traps. Ellis Drier Co., Chicago, Ill.

Red Top — Humidistats, thermostats. H-B Instrument Co., Philadelphia, Pa.

Redi—Stokers. General Machinery Co., Spokane, Wash.

Redi-Return—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

Redi-Vac—Pumps. American - Marsh Pumps, Inc., Battle Creek, Mich.

Redsquare—Boilers. Utica Radiator Corp., Utica, N. Y.

Relatrol—Heating systems. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Reliance—Packing. Chicago Belting Co., Chicago, Ill.

Reliance—Regulators. American Meter Co., Inc., New York, N. Y.

Reliance—Regulators. General Controls Co., Glendale, Cal.

Remco—Bases. Manley Products Corp., York, Pa.

Renewo—Valves. Lunkenheimer Co., Cincinnati, O.

Renu-Vent—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Research—Belting. Graton & Knight Mfg. Co., Worcester, Mass.

Reverbolite—Insulation. Celotex Corp., The, Chicago, Ill.

Rex—Chain drives, couplings, nozzles, pillow blocks, pumps. Chain Belt Co., Milwaukee, Wis.

Rex-AC—Pillow blocks, blowers, fans. Air Controls, Inc., Cleveland, O.

Rex-Airate—Roof ventilators, blower wheels. Air Controls, Inc., Cleveland, O.

Rexoil—Burners, heaters. Reif-Rexoil, Inc., Buffalo, N. Y.

Rexvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Rex-Weld—Hose. Chicago Metal Hose Corp., Maywood, Ill.

Rhino—Calking compounds. Pecora Paint Co., Philadelphia, Pa.

Richvar—Radiation. Richmond Radiator Co., Gas Products Div., Uniontown, Pa.

Ridgid—Pipe machines, wrenches, cutters, vises. Ridge Tool Co., Elyria, O.

Rifco—Unions. Rhode Island Fittings Co., Hillsgrove, R. I.

Rihco—Humidifiers. Rhode Island Humidifier & Ventilating Co., Boston, Mass.

Rip-pl—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Rocktex—Insulation. Carey Co., Philip, Lockland, Cincinnati, O.

Rocop—Heaters. Rome-Turney Radiator Co., Rome, N. Y.

Rodpax—Packing. National Engineering Products, Inc., Washington, D. C.

Roofvane—Ventilators. Sturtevant Co., B. F., Boston, Mass.

Roof-Vent—Ventilators. Reed Unit-Fans, Inc., New Orleans, La.

Rotameter—Flow meters. Schutte & Koerting Co., Philadelphia, Pa.

Roto Blast—Furnaces. Moncrief Furnace Co., Atlanta, Ga.

Roto-Clone—Dust collectors. American Air Filter Co., Inc., Louisville, Ky.

Rotohood—Uno Ventilator Co., Cliftondale, Mass.

Rotojet—Spray nozzles. Binks Mfg. Co., Chicago, Ill.

Royal—Boilers, water heaters. Hart & Crouse Corp., Utica, N. Y.

Rubalt—Enamels and lacquers. Hague & Co., Inc., Alfred, Brooklyn, N. Y.

Rubyfluid—Solder. Ruby Chemical Co., Columbus, O.

Runwel—Packing. Greene, Tweed & Co., New York, N. Y.

Rusco—Insulation. Russell Co., F. C., Cleveland, O.

Rustop—Boiler cleaning compounds, water treatment. Aquatic Chemical Laboratories, Inc., New York, N. Y.

SA—Valves. Lunkenheimer Co., Cincinnati, O.

S. C.—Air heaters. Surface Combustion Corp., Toledo, O.

S-N—Water heaters. Scott-Newcomb, Inc., St. Louis, Mo.

S & P—Burners, governors, preheaters, regulators, strainers, valves. Staples & Pfeiffer, Ltd., San Francisco, Cal.

Saf-Dry—Refrigerants. Liquid Carbonic Corp., The, Chicago, Ill.

Sal-Mo—Cement, insulation, packing. Sall Mountain Co., Chicago, Ill.

Sanidaire—Humidifiers. U. S. Air Conditioning Corp., Minneapolis, Minn.

Santrol—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Saunders—Pipe cutters. Erie Tool Works, Erie, Pa.

Sauter—Time switches. Cramer Co., Inc., R. W., The, Centerbrook, Conn.

Schwan—Gas burners. Jamieson Mfg. Co., Dallas, Texas.

Scroll-Pivoter—Shears. Wiss & Sons Co., J., Newark, N. J.

Scru-peller—Ejectors. Chicago Pump Co., Chicago, Ill.

Sea Lion—Packing. Chicago Belting Co., Chicago, Ill.

Seal Master—Bearings. Stephens-Adamson Mfg. Co., Aurora, Ill.

Sealkote—Cement. Keasbey & Mattison Co., Ambler, Pa.

Seal-Less — Compressors. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Seal-Rite—Cement and compounds. Macksons Co., New York, N. Y.

Searight—Shears. Bartlett Mfg. Co., Detroit, Mich.

Seigelite — Gaskets. Johns-Manville, New York, N. Y.

Seismo-Dampers—Bases. Korfund Co., Long Island City, N. Y.

Sells—Bearings. Royersford Foundry & Machine Co., Royersford, Pa.

Sensatherm — Thermostats. Mercoid Corp., Chicago, Ill.

Sensitrol—Relays. Weston Electrical Instrument Corp., Newark, N. J.

Sentry—Smoke alarms. Boiler Room Equipment, Inc., New York, N. Y.

Serrabestos—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Service—Packing. Johns-Manville, New York, N. Y.

Sesure—Gages. Yarnall-Waring Co., Philadelphia, Pa.

"78"—Traps. Webster & Co., Warren, Camden, N. J.

Shawco—Bends, headers. Shaw Co., Benjamin F., Wilmington, Del.

Shelby—Tubing. National Tube Co., United States Steel Corp. Sub., Pittsburgh, Pa.

Shield-Arc — Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Shock Pads—Bases and pads. Butterworth, Jr., B. T., New Canaan, Conn.

Shut-O-Vent—Louvers and shutters. Reed Unit-Fans, Inc., New Orleans, La.

Silent Air—Fans. Belanger Fan & Blower Co., Detroit, Mich.

Silentblu—Gas burners. Beck Engineering Combustion Kompany, St. Louis, Mo.

Silentvane—Fans. Sturtevant Co., B. F., Boston, Mass.

Sil-Fos—Solder. Handy & Harman, New York, N. Y.

Silicair—Insulation. Western Silicair Products, Inc., Burbank, Cal.

Silverlink—Chain drives. Link-Belt Co., Indianapolis, Ind.

Silverseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Silverstreak—Chain drive. Link-Belt Co., Indianapolis, Ind.

Silvertop—Eliminators, traps. Anderson Co., V. D., The, Cleveland, O.

Simplex—Gages. Viking Pump Co., Cedar Falls, Ia.

Simplex—Pipe vises. Desmond-Stephan Mfg. Co., Urbana, O.

Simplex—Quadrants. Ohio Products Co., Cleveland, O.

Sirocco—Blowers, dust collectors, fans, grilles, unit air conditioners, unit air coolers, unit air humidifiers, air washers. American Blower Corp., Detroit, Mich.

Smoot—Combustion control systems, regulators. Republic Flow Meters Co., Chicago, Ill.

Sodrin—Boiler and radiator sealing compound. Dole Valve Co., The, Chicago, Ill.

Softweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Solray—Radiation. Weil-McLain Co., Chicago, Ill.

Sonistat—Gages. American Air Filter Co., Inc., Louisville, Ky.

Sono-O-Seal—Insulation. General Insulating Products Co., Brooklyn, N. Y.

Sovereign—Packing. Darcoid Co., Inc., New York, N. Y.

Spalding—Furnaces. Air Devices, Inc., New York, N. Y.

Spatter Film—Electrodes. Lincoln Electric Co., Cleveland, O.

Special X—Solder. Industrial Service Laboratories, Milwaukee, Wis.

Speed Heater—Unit heaters. Sturtevant Co., B. F., Boston, Mass.

Speedarc—Electrodes. Universal Power Corp., Cleveland, O.

Spider Web—Air filters. Wilson & Co., Chicago, Ill.

Spiralaire—Oil burners. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Spiralwound—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Spirodome — Spray nozzles. Cooling Tower Co., Inc., The, Div. of the Fluor Corp., Ltd., New York, N. Y.

Spirotallic — Gaskets. Johns-Manville, New York, N. Y.

Spirovane—Fans. Western Blower Co., Seattle, Wash.

Sporlan—Valves. Spoehrer-Lange Co., St. Louis, Mo.

Spraco—Fans, nozzles, separators, strainers, washers. Spray Engineering Co., Somerville, Mass.

Spra-Rite—Nozzles. Binks Mfg. Co., Chicago, Ill.

Spray-Acoustic—Insulation. Sprayo-Flake Co., Chicago, Ill.

Stabilflo—Valves. Foxboro Co., Foxboro, Mass.

Stable-Arc—Electrodes, arc welders. Lincoln Electric Co., Cleveland, O.

Stacon—Regulators, valves. Edison, Inc., Thomas A., Edison Electrical Controls Div., West Orange, N. J.

Staidarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainarc—Electrodes. Universal Power Corp., Cleveland, O.

Stainless—Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Stainweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Standard—Humidistats. Spencer Thermostat Co., Attleboro, Mass.

Standard—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Star—Ventilators. Merchant & Evans Co., Philadelphia, Pa.

Statictrol—Pressure and vacuum switches. Automatic Control Co., St. Louis, Mo.

Steelok—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Sterilamp—Lamps. Westinghouse Electric & Mfg. Co., Bloomfield, N. J.

Sterlco—Circulators, controls, eliminators, floats, gages, pumps, strainers, heating systems, traps, valves. Sterling, Inc., Milwaukee, Wis.

Stictite—Cement. Refractory & Insulation Corp., New York, N. Y.

Stokerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Stokol—Stokers, water heaters. Schwitzer-Cummins Co., Indianapolis, Ind.

Stowe—Stokers. Johnston & Jennings Co., Cleveland, O.

Streamaire—Unit heaters, radiation, cooling surface. Young Radiator Co., Racine, Wis.

Stronghold—Belting. Rhoads & Sons, J. E., Philadelphia, Pa.

Stud-Pak—Insulation. United States Mineral Wool Co., Chicago, Ill.

Sullarc—Electrodes. Universal Power Corp., Cleveland, O.

Sunrad—Radiation. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Super Air Screws—Fans. Marathon Electric Mfg. Corp., Wausau, Wis.

Super Cold Fin—Cooling surface. Rempe Co., Chicago, Ill.

Super Silvertop—Traps. Anderson Co., V. D., The, Cleveland, O.

Supercord—V belts. Browning Mfg. Co., Inc., Maysville, Ky.

Super-deLavaud—Pipe. U. S. Pipe & Foundry Co., Burlington, N. J.

Superector—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-Fan—Fan blades. Norwin Co., Freeport, Ill.

Superheat—Packing, Keasbey & Mattison Co., Ambler, Pa.

Superior—Wrenches. Williams & Co., J. H., New York, N. Y.

Superjustable—Wrenches. Williams & Co., J. H., New York, N. Y.

Superratchet—Ratchet wrenches. Williams & Co., J. H., New York, N. Y.

Superrench—Wrenches. Williams & Co., J. H., New York, N. Y.

Super-S—Gages. Klingerit, Inc., New York, N. Y.

Supersocket—Wrenches. Williams & Co., J. H., New York, N. Y.

Supertemp — Insulation. Eagle-Picher Lead Co., Cincinnati, O.

Supertherm—Systems. Ross Engineering Corp., J. O., New York, N. Y.

Super-type — Unit heaters. Autovent Fan & Blower Co., Chicago, Ill.

Sure Hot—Heaters, valves. Little Mfg. Co., M. S., Hartford, Conn.

Sure Return — Condensation return pumps. Chicago Pump Co., Chicago, Ill.

Sure Seal — Cement and compounds. Grinnell Co., Inc., Providence, R. I.

Surevent—Valves. Gorton Heating Corp., Cranford, N. J.

Surlock—Registers. Tuttle & Bailey, Inc., New Britain, Conn.

Sylphon — Bellows, joints, operators, regulators, valves. Fulton Sylphon Co., Knoxville, Tenn.

Sylphon—Traps, valves. Webster & Co., Warren, Camden, N. J.

Synchro-Meter—Meters. Bailey Meter Co., Cleveland, O.

Synchrotax—Thermostats. Foxboro Co., Foxboro, Mass.

Synchrotie—Recorders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Syncretizer—Unit ventilators. Nesbitt, Inc., John J. & Buckeye Blower Co., Philadelphia, Pa.

TE—Compressors. Janette Mfg. Co., Chicago, Ill.

T.T.—Smoke guns. Hill, E. Vernon, Chicago, Ill.

Tabasco — Water heaters. Kewanee Boiler Corp., Kewanee, Ill.

Tag—Humidistats, hygrometers, manometers, meters, psychrometers, recorders, regulators, thermometers, traps, valves. Tagliabue Mfg. Co., C. J., Brooklyn, N. Y.

Tampico—Air filters. Chicago Filter Co., Joliet, Ill.

Tanktrol—Regulators. Automatic Control Co., St. Paul, Minn.

Tannate—Belting, packing. Rhoads & Sons, J. E., Philadelphia, Pa.

Tanseal—Packing. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Techni-Turn—Vanes. Waterloo Register Co., Waterloo, Ia.

Techni-Vane—Vanes. Waterloo Register Co., Waterloo, Ia.

Teksag Colloid—Boiler compounds. American Teksag Products Co., Inc., Mount Vernon, N. Y.

Televisor—Gages. Schutte & Koerting Co., Philadelphia, Pa.

Teltru—Anemometers, gages. Hill, E. Vernon, Chicago, Ill.

Tem-Clock (Electric)—Time switches. Penn Electric Switch Co., Goshen, Ind.

Temcoustic — Insulation. Armstrong Cork Co., Lancaster, Pa.

Temlok—Insulation. Armstrong Cork Co., Lancaster, Pa.

Temperator — Unit air conditioners. Dunham Co., C. A., Chicago, Ill.

TempOstats—Thermostats. D & M Mfg. Co., Midland Park, N. J.

Tempryte — Windows. Truscon Steel Co., Youngstown, O.

Texbord—Insulation. Celotex Corp., The, Chicago, Ill.

Texrope—V-belt drives, pulleys, v-belts. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Thawzone—Dehydrant and acid neutralizer. Highside Chemicals Co., Newark, N. J.

Therhumiter—Thermometers. Weksler Thermometer Corp., New York, N. Y.

Thermair—Furnaces, heaters. New York Blower Co., Chicago, Ill.

Thermalfin—Unit coolers. Thermal Co., Inc., Milwaukee, Wis.

Thermalfuel—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Therm-A-Lute — Cement and compounds. Superior Valve & Fittings Co., Pittsburgh, Pa.

Thermax—Insulation. Celotex Corp., The, Chicago, Ill.

Thermidaire—Burners, furnaces, heaters. Campbell Heating Co., E. K., Kansas City, Mo.

Thermix—Dust collector. Prat-Daniel Corp., Port Chester, N. Y.

Thermo—Expansion valves. Alco Valve Co., St. Louis, Mo.

Thermo—Heaters. American Furnace Co., St. Louis, Mo.

Thermofin — Radiation. Grinnell Co., Inc., Providence, R. I.

Thermoflex—Strainers, heating systems, traps, valves. Cashin Co., W. D., Boston, Mass.

Thermogas—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermoguard—Bi-metals. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Thermoguide—Thermometers. Taylor Instrument Companies, Rochester, N. Y.

Thermoil—Furnaces. Beck Engineering Combustion Kompany, St. Louis, Mo.

Thermolier—Unit heaters. Grinnell Co., Inc., Providence, R. I.

Thermopane—Windows. Libbey-Owens Ford Glass Co., Toledo, O.

Therm-o-tile—Conduit. Porter & Co., Inc., H. W., Newark, N. J.

Thermotrol—Valves. Sterling Engineering Co., Milwaukee, Wis.

Thermovent—Unit ventilators. Nesbitt, Inc., John J., & Buckeye Blower Co., Philadelphia, Pa.

Thor—Drills, pumps. Independent Pneumatic Tool Co., Chicago, Ill.

Thredolets—Fittings. Bonney Forge & Tool Wks., Allentown, Pa.

Thrift—Air heaters. Surface Combustion Corp., Toledo, O.

Thrift—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Throway—Air filters. American Air Filter Co., Inc., Louisville, Ky.

Ticone—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Tighton—Unions. Standard Union Co., New York, N. Y.

Timercoid—Time switches. Mercoid Corp., Chicago, Ill.

Timerelay—Relays. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Timetrol (Manual) — Time switches. Penn Electric Switch Co., Goshen, Ind.

Tiny—Traps. Nason Co., Detroit, Mich.

Tiscot—Boilers. Titusville Iron Wks. Co., Titusville, Pa.

Titan—Traps. Nason Co., Detroit, Mich.

Titeseal—Cement and compounds. Radiator Specialty Co., Charlotte, N. C.

Tom Thumb—Pipe machines. Oster Mfg. Co., Cleveland, O.

Toncan—Pipe, sheets. Republic Steel Corp., Cleveland, O.

Toncanarc—Electrodes. Universal Power Corp., Cleveland, O.

Toolweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Torkflash—Wrenches. Blackhawk Mfg. Co., Milwaukee, Wis.

Torqometer — Torque indicating wrenches. Snap-On Tools Corp., Kenosha, Wis.

Transite — Pipe, refractories. Johns-Manville, New York, N. Y.

Trans-Lux — Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

Transweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Tray—Cooling towers. New England Cooling Tower Co., Boston, Mass.

Trem-Bar—Insulation. United States Gypsum Co., Chicago, Ill.

Trimo—Cutters, vises, wrenches. Trimont Mfg. Co., Boston, Mass.

Trimo—Cutters. Erie Tool Works, Erie, Pa.

Tripl-Disc — Valves. Rockford Brass Works, Rockford, Ill.

Triple Duty—Boilers. Bass Foundry & Machine Co., Ft. Wayne, Ind.

Tri-Sli—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tritrol—Regulators, switches, thermostats. Marsh Corp., Jas. P., Chicago, Ill.

Triumph—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Trojan—Boilers, Burnham Boiler Corp., Irvington, N. Y.

Truflex—Bi-metals. General Plate Div., Metals & Controls Corp., Attleboro, Mass.

Tufferneli—Cement. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Turbo—Air washers, spray nozzles. Bayley Blower Co., Milwaukee, Wis.

Turbo Vane—Fans and blowers. B. F. Sturtevant Co., Boston, Mass.

Turbo-Aquatherm — Water heaters. Dahlquist Mfg. Co., Inc., Boston, Mass.

Turret — Pumps. Yeomans Bros. Co., Chicago, Ill.

Tuway—Strainers. Wright-Austin Co., Detroit, Mich.

20th Century—Bearings. Roller Bearing Co. of America, Trenton, N. J.

Twin Contact—Controls. Perfex Corp. (Controls Div.), Milwaukee, Wis.

Two Way—Dampers. Tuttle & Bailey, Inc., New Britain, Conn.

Tymit—Switches. Tork Clock Co., Inc., Mt. Vernon, N. Y.

Type ME—Blower wheels, fans. New York Blower Co., Chicago, Ill.

Tytecote—Insulation. Specialty Converters, Inc., East Braintree, Mass.

UAC—Unit air conditioners. Burnham Boiler Corp., Irvington, N. Y.

UAC—Unit heaters. Surface Combustion Corp., Toledo, O.

UACD—Unit heaters. Surface Combustion Corp., Toledo, O.

UAS—Unit heaters. Surface Combustion Corp., Toledo, O.

U. F. S.—Clamps. Grinnell Co., Inc., Providence, R. I.

U. S.—Unions. United Superior Union Co., Inc., Brooklyn, N. Y.

USS—Sheets, structural shapes. Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

U. S. Airco—Air conditioning equipment, speed changers. U. S. Air Conditioning Corp., Minneapolis, Minn.

UTA—Pumps. American-Marsh Pumps, Inc., Battle Creek, Mich.

U-Loy—Sheets. Republic Steel Corp., Cleveland, O.

Uniblade—Fans. Autovent Fan & Blower Co., Chicago, Ill.

Unicool—Humidifiers, unit air conditioners, unit air coolers, unit air humidifiers, air washers. Betz Unit Air Cooler Co., Kansas City, Mo.

Uni-fin—Grilles, registers. Barber-Colman Co., Rockford, Ill.

Uni-flo—Air diffusers, dampers, grilles. Barber-Colman Co., Rockford, Ill.

Uniflow—Oil burners. Ace Engineering Co., Chicago, Ill.

Unisorb—Bases and pads, insulation. Felters Co., Inc., Boston, Mass.

Unitaire—Unit air conditioners. Westinghouse Electric & Mfg. Co., East Springfield, Mass.

Unitherm—Unit heaters and coolers. Clarage Fan Co., Kalamazoo, Mich.

Unitherm—Thermostats, valves. Walker and Eder, Inc., New York, N. Y.

Unitrol—Regulators, switches, thermostats. Marsh Tritrol Co., Chicago, Ill.

Universal—Benders. Hossfeld Mfg. Co., Winona, Minn.

Universal—Air filters. Hugo Mfg. Co., West Duluth, Minn.

Universal—Gas and oil burners. Mettler Co., Lee B., Los Angeles, Cal.

Universal — Packing. Johns-Manville, New York, N. Y.

Universal—Regulators. Dockson Corp., Detroit, Mich.

Utica—Radiation. International Heater Co., Utica, N. Y.

Utility — Compressors. Schramm, Inc., West Chester, Pa.

Utility—Packing. Keasbey & Mattison Co., Ambler, Pa.

Utilus—Fans. Hirschman Co., W. F., Buffalo, N. Y.

V.R.D.—Speed changers. Link-Belt Co., Philadelphia, Pa.

Vacu-Draft—Blowers. Muncie Gear Wks., Inc., Muncie, Ind.

Vacuumstat — Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Valcalox—Damper regulators. Young Regulator Co., Cleveland, O.

Valpit—Unions. Pittsburgh Valve & Fittings Corp., Barberton, O.

Vaporstat—Switches. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Vari-Pitch—Speed changers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Veelos—V-belts. Manheim Mfg. & Belting Co., Manheim, Pa.

Velometer—Air velocity meters. Illinois Testing Laboratories, Inc., Chicago, Ill.

Velvet—Cement. Keasbey & Mattison Co., Ambler, Pa.

Vent-Vac—Heating systems. Anderson Products, Inc., Cambridge, Mass.

Ventil-aire—Window ventilator and filter units. Fairbanks, Morse & Co., Chicago, Ill.

Vento — Heating surface. American Radiator & Standard Sanitary Corp., Pittsburgh, Pa.

Vent-Rite—Air valves, air eliminators. Anderson Products, Inc., Cambridge, Mass.

Ventura—Fans. American Blower Corp., Detroit, Mich.

Venturafin—Unit heaters. American Blower Corp., Detroit, Mich.

Venturi—Meters. Builders Iron Foundry, Providence, R. I.

Venturi-Flo—Air diffusers. Barber-Colman Co., Rockford, Ill.

Vernier-Set—Time switches. Automatic Temperature Control Co., Inc., Philadelphia, Pa.

Vibracork—Bases. Armstrong Cork Co., Lancaster, Pa.

Vibro Insulators—Bases. Goodrich Co., B. F., Akron, O.

Vibro-Dampers — Bases. Korfund Co., Long Island City, N. Y.

Victor—Regulators. Atlas Valve Co., Inc., Newark, N. J.

Victor—Steam traps. Wright-Austin Co., Detroit, Mich.

Vistand—Vise stands. Armstrong Mfg. Co., Bridgeport, Conn.

Vitalaire—Air conditioning units. Ice Cooling Appliance Corp., Morrison, Ill.

Vitalloy—Wrenches. Billings & Spencer Co., Hartford, Conn.

Vitra-Carlite—Enamels and lacquers. Hilo Varnish Corp., Brooklyn, N. Y.

V-Meth-L — Refrigerant. Virginia Smelting Co., West Norfolk, Va.

Volcano—Ventilators. Iwan Brothers, South Bend, Ind.

Vortex—Pumps. Lawrence Pump & Engine Co., Lawrence, Mass.

V-tite—Gaskets. Goetze Gasket & Packing Co., Inc., New Brunswick, N. J.

Vulcalock—Fittings, pipe, valves. Goodrich Co., B. F., Akron, O.

Vulcan—Stands, tongs, vises. Williams & Co., J. H., New York, N. Y.

Vulcan—Unions. Rockwood Sprinkler Co., Worcester, Mass.

Vulco — Belts, drives. Gates Rubber Co., Denver, Col.

WHS—Couplings, drives, reducers. Smith, Inc., Winfield H., Springville, N. Y.

WJ—Boiler cleaning compound. Radiator Specialty Co., Charlotte, N. C.

W. & McD.—Strainers, valves. Watson & McDaniel Co., Philadelphia, Pa.

W-S—Fittings. Watson Stillman Co., Roselle, N. J.

Walco-Parmelee—Wrenches. Walworth Co., New York, N. Y.

Wallvane—Fans. Sturtevant Co., B. F., Hyde Park, Boston, Mass.

Walseal Silbraz—Fittings, valves. Walworth Co., New York, N. Y.

Walton—Air filters. Research Products Corp., Madison, Wis.

Warco—Valves. Russell & Co., W. A., Bridgeport, Conn.

Water-Boy—Feeders. Maid-O-Mist, Inc., Chicago, Ill.

Waterfilm—Boilers. Koven & Bro., Inc., L. O., Jersey City, N. J.

Water-Ray-Trola — Heaters. Ray Oil Burner Co., San Francisco, Cal.

Weaco—Preheaters, thermostats. Warren Electric Appliance Co., Warren, Pa.

Wear-Proof—Pumps. Schneible Co., Claude B., Chicago, Ill.

Wearweld—Electrodes. Lincoln Electric Co., Cleveland, O.

Weathermaker—Unit air conditioners. Carrier Corp., Syracuse, N. Y.

Weatherstat—Thermostats. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Weatherwood—Insulation. United States Gypsum Co., Chicago, Ill.

Webster-Nesbitt—Unit heaters. Webster & Co., Camden, N. J.

Webster-Nesbitt—Unit heaters and air conditioners. Nesbitt, Inc., John J., Philadelphia, Pa.

Wedgbelt—V belts and v-belt drives, pulleys. American Pulley Co., Philadephia, Pa.

Weldells—Welding fittings. Taylor Forge & Pipe Works, Chicago, Ill.

Weldfast—Welding rod. Revere Copper & Brass, Inc., New York, N. Y.

Weldolets—Fittings. Bonney Forge & Tool Works, Allentown, Pa.

Weldomatic—Arc welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weldotrol—Spot welders. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Weld-O-Tron—Arc welders. Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Westco—Pumps. Micro-Westco, Inc., Bettendorf, Ia.

Whirljet—Spray nozzles. Spraying Systems Co., Chicago, Ill.

White Rock—Insulation. Celotex Corp., The, Chicago, Ill.

Wilco—Bi-metals. Wilson Co., H. A., The, Newark, N. J.

Wilco—Pipe cutting machines. Oster Mfg. Co., Cleveland, O.

Willie Williams — Pipe cutting and threading machines. Oster Mfg. Co., Cleveland, O.

Wilson—Arc welders. Air Reduction Sales Co., New York, N. Y.

Windowstat—Condensation control. Friez & Sons, Julien P., Baltimore, Md.

Wind-O-Vane—Propeller fans. Sturtevant Co., B. F., Boston, Mass.

Wind-O-Vent—Window ventilator and filter units. Reed Unit-Fans, Inc., New Orleans, La.

Wing-Scruplex — Fans, ventilators. Wing Mfg. Co., L. J., New York, N. Y.

Winner—Registers. Auer Register Co., Cleveland, O.

Wissco—Grilles, welding rod. Wickwire Spencer Steel Co., New York, N. Y.

Witch—Hangers, protectors. Carpenter & Paterson, Inc., East Boston, Mass.

Wizardaire—Air conditioning units, humidifiers. Certified Products Co., Toledo, O.

Wolverine—Fans, ventilators. Belanger Fan & Blower Co., Detroit, Mich.

Wonder—Benders. American Pipe Bending Machine Co., Inc., Boston, Mass.

Wrigley—Bolts. Chicago Expansion Bolt Co., Chicago, Ill.

X-L — Gaskets, packing. Excelsior Leather Washer Co., Rockford, Ill.

Xacto—Meters. Bowser & Co., Inc., S. F., Fort Wayne, Ind.

Xit—Ventilators. Iona Ventilator Co., Inc., Philadelphia, Pa.

Yager—Solder. Benson Co., Inc., Alex R., Hudson, N. Y.

Yarway—Expansion joints, nozzles, traps, valves. Yarnall-Waring Co., Philadelphia, Pa.

Yello-Jacket—Heating boilers. Burnham Boiler Corp., Irvington, N. Y.

Yorkaire—Unit air coolers. York Ice Machinery Corp., York, Pa.

Zeph-o-Cone—Air diffusers. Waterloo Register Co., Waterloo, Ia.

Zincgrip — Sheets. American Rolling Mill Co., Middletown, O.

Zonolite—Insulation. Munn and Steele, Inc., Newark, N. J.

DIRECTORY SECTION

HEATING, PIPING AND AIR CONDITIONING EQUIPMENT FOR INDUSTRY AND LARGE BUILDINGS

PART 3—MANUFACTURERS' ADDRESSES

A

Accurate Mfg. Works, 2336-38 Milwaukee Ave., Chicago, Ill.
Accurate Metal Weather Strip Co., 216 E. 26th St., New York, N. Y.
Ace Engineering Co., 1735 W. 31st St., Chicago, Ill.
Acer & Whedon, Medina, N. Y.
Acheson Mfg. Co., Braddock P. O., Rankin, Pa.
Acker Organization, Inc., W. M., 3167 Fulton Rd., Cleveland, O.
Acme Asbestos Covering & Flooring Co., 236 N. Elizabeth St., Chicago, Ill.
Acme Electric Welder Co., 5619 Pacific Blvd., Huntington Park, Cal.
Acme Heating & Ventilating Co., Inc., 4224 Lowe Ave., Chicago, Ill.
●Acme Industries, Inc., Cor. Mechanic and Ganson Sts., Jackson, Mich.
Acme Refining Co., The, W. 56th & W. & L. E. Ry., Cleveland, O.
Acme Tin Plate & Roofing Supply Co., 10th and York Sts., Philadelphia, Pa.
Acorn Refining Co., 8001 Franklin Ave., Cleveland, O.
Adam Electric Co., Frank, 3650 Windsor St., St. Louis, Mo.
Adams Co., The, E. 4th St., Dubuque, Ia.
Adams Co., R. P., 55 Chicago St., Buffalo, N. Y.
Adams Mfg. Co., J. D., 217 S. Belmont Ave., Indianapolis, Ind.
Ad-Lee Co., Inc., 825 S. Wabash Ave., Chicago, Ill.
Advance Aluminum Castings Corp., 2742 W. 36th Pl., Chicago, Ill.
Advance Electric Co., 1260 W. Second St., Los Angeles, Cal.
Advance Fan & Blower Co., 3428 Bagley, Detroit, Mich.
Advance Insulating Co., Magee Bldg., Pittsburgh, Pa.
Advanced Refrigerating Systems Co., 33rd and Arch Sts., Philadelphia, Pa.
Aeco Packing Products Co., 215 W. Illinois St., Chicago, Ill.
Aeolus Dickinson Co., 3320 S. Artesian Ave., Chicago, Ill.
●Aerofin Corp., 410 S. Geddes St., Syracuse, N. Y.
Aeroil Burner Co., Inc., Park Ave. at 57th St., West New York, N. J.
Aerovent Fan Co., 710 E. Ash St., Piqua, O.
Agnew Electric Co., Milford, Mich.
Ahlberg Bearing Co., 3081 W. 47th St., Chicago, Ill.
Air Conditioning Products Co., 1230-18th St., Detroit, Mich.
Air Control Products, Inc., Glades St. and Larch, Muskegon, Mich.
●Air Controls, Inc., 1935 W. 114th St., Cleveland, O.
●Air Devices, Inc., 17 E. 42nd St., New York, N. Y.
Air Filter Engineering Co., 2236 S. Wabash Ave., Chicago, Ill.
Air Filter Engineering Co., Omaha, Nebr.
Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.
●Air & Refrigeration Corp., 11 W. 42nd St., New York, N. Y.
Aire-Foile Fan & Blower Co., 4737 W. Vernor Highway, Detroit, Mich.
Airgard Mfg. Co., 609 N. La Salle St., Chicago, Ill.
Airmaster Corp., 4317 Ravenswood Ave., Chicago, Ill.
●Air-Maze Corp., 5200 Harvard Ave., Cleveland, O.
Airmode Mfg. Co., 325 W. Huron St., Chicago, Ill.
Airo Supply Co., 2726 N. Ashland Ave., Chicago, Ill.
Air-O-Cel Industries, Inc., 11616 Cloverdale Ave., Detroit, Mich.
Air-O-Line Co., The, 2118 Griffin St., Dallas, Tex.
●Airox Co., 366 Madison Ave., New York, N. Y.
●Air-Stream Filter Corp., 2100 Washington Ave., St. Louis, Mo.
Airtemp, Div. of Chrysler Corp., Leo St., Dayton, O.
●Airtherm Mfg. Co., 700 S. Spring Ave., St. Louis, Mo.
Airwasher Corp., 1122 N. Washington Ave., Lansing, Mich.
Ajax Flexible Coupling Co., Westfield, N. Y.
Akron Metallic Gasket Co., 155 N. Union, Akron, O.
Akwa Heaters, Inc., 1955 Park Ave., New York, N. Y.
Alabama Pipe Co., Anniston, Ala.
Albright Equipment Co., 405 Penn Ave., Pittsburgh, Pa.
●Alco Valve Co., 2628 Big Bend Blvd., St. Louis, Mo.
Aldrich Pump Co., 4 Pine St., Allentown, Pa.
Alexander Bros., 406 N. 3rd, Philadelphia, Pa.
Alfol Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
All Metal Weatherstrip Co., 229 W. Illinois St., Chicago, Ill.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Allen Billmyre Corp., 132 Water St., South Norwalk, Conn.
Allen Corp., 9767 Erwin Ave., Detroit, Mich.
●Allen-Bradley Co., 1335 S. First St., Milwaukee, Wis.
Allis Co., Louis, The, 427 E. Stewart St., Milwaukee, Wis.
●Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Alloy Steel Products Co., 1000 W. Elizabeth Ave., Linden, N. J.
Allpax Co., Inc., Mamaroneck, N. Y.
Alpha Metal & Rolling Mills, Inc., 363 Hudson Ave., Brooklyn, N. Y.
Alphil Spot Welding Co., 431 W. Broadway, New York, N. Y.
Alten's Foundry & Machine Works, 226 W. Wheeling St., Lancaster, O.
Alter Co., Harry, 1728 S. Michigan Ave., Chicago, Ill.
Alter-Arc Mfg. Co., 209 B St., Lawton, Okla.
Alton Mineral Wool Insulation Co., P. O. Box 268, Alton, Ill.
Aluminum Aircell Insulation Co., Curtis Bldg., Detroit, Mich.
Aluminum Co. of America, 801 Gulf Bldg., Pittsburgh, Pa.
American Agile Corp., 5806 Hough Ave., Cleveland, O.
●American Air Filter Co., Inc., 107 Central Ave., Louisville, Ky.
American Barlock Co., Inc., 36-32 38th St., Long Island City, N. Y.
American Blower Corp., 6000 Russell St., Detroit, Mich.
American Bosch Corp., 3664 Main St., Springfield, Mass.
American Brass Co., 414 Meadow St., Waterbury, Conn.
American Cast Iron Pipe Co., 2930 N. 16th St., Birmingham, Ala.
American Coal Burner Co., 155 E. Superior St., Chicago, Ill.
American Coils, Inc., 25-27 Lexington St., Newark, N. J.
American Coolair Corp., 3604 Mayflower St., Jacksonville, Fla.
American Cooling Tower Co., 2710 McGee St., Kansas City, Mo.
●American District Steam Co., Bryant St., North Tonawanda, N. Y.
American District Telegraph Co., 155 E. 6th Ave., New York, N. Y.
American Engineering Co., Aramingo Ave. and Cumberland St., Philadelphia, Pa.
American Flange & Mfg. Co., Inc., 1901 R. C. A. Bldg., New York, N. Y.
American Flexible Coupling Co., 1801 Pittsburgh Ave., Erie, Pa.
American Foundry Equipment Co., 619 Byrkit St., Mishawaka, Ind.
American Foundry & Furnace Co., Washington St. at McClun, Bloomington, Ill.
American Furnace Co., 2719-31 Delmar Blvd., St. Louis, Mo.
American Hair & Felt Co., 1828 Merchandise Mart, Chicago, Ill.
American Hammered Piston Ring Div., Koppers Co., Bush and Hamburg Sts., Baltimore, Md.
American Hard Rubber Co., 11 Mercer St., New York, N. Y.
American Hydrozone Co., Inc., 10 E. 40th St., New York, N. Y.
American Injector Co., 1481-14th St., Detroit, Mich.
American Instrument Co., Silver Spring, Md.
American-Larson Ventilating Co., 1004 Keystone Bank Bldg., Pittsburgh, Pa.
American Locomotive Co., Alco Products Div., 30 Church St., New York, N. Y.
American Locomotive Co., Diesel Engine Div., Auburn, N. Y.
American Manganese Bronze Co., Rhawn & Hegerman Sts., Philadelphia, Pa.
American-Marsh Pumps, Inc., 60 Capital Ave., N. E., Battle Creek, Mich.
American Metal Hose Branch, American Brass Co., 67 Jewelry St., Waterbury, Conn.
American Metal Products Co., 730 Hudgins St., Forth Worth, Tex.
American Metal Weather Strip Co., 144 N. Division Ave., Grand Rapids, Mich.
American Meter Co., Inc., 105 W. 40th St., New York, N. Y.
American Moistening Co., 260 W. Exchange St., Providence, R. I.
American Nickeloid Co., 113 Second St., Peru, Ill.
American Pipe Bending Machine Co., Inc., 37 Pearl St., Boston, Mass.
American Pipe Tool Co., 4856 W. Kinzie St., Chicago, Ill.
American Pulley Co., 4200 Wissahickon Ave., Philadelphia, Pa.
American Radiator & Standard Sanitary Corp., Bessemer Bldg., Pittsburgh, Pa.
●American Rolling Mill Co., The, 703 Curtis St., Middletown, O.
American Schaefer & Budenberg Instrument Div., Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport, Conn.
American Sheet Metal Works, 331 N. Alexander, New Orleans, La.
American Solder & Flux Co., Wayne Ave. and Berkley St., Philadelphia, Pa.

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American Steel & Wire Co., Rockefeller Bldg., Cleveland, O.
American Teksag Products Co., Inc., 395 N. MacQuesten Pkwy., Mt. Vernon, N. Y.
American Thermometer Co., 2907 Clark Ave., St. Louis, Mo.
American Warming & Ventilating Co., 1017-1021 Summit St., Toledo, O.
American Water Softener Co., Lehigh Ave. and 4th St., Philadelphia, Pa.
American Well Wks., 100 N. Broadway, Aurora, Ill.
American Zinc Products Co., Greencastle, Ind.
Ames Co., W. R., 150 Hooper St., San Francisco, Cal.
Ames Hydrovac Corp., 290 Scholes St., Brooklyn, N. Y.
Ames Iron Works, Division of Pierce Butler Radiator Corp., Oswego, N. Y.
Amirton Co., 48 N. Central Ave., Elmsford, N. Y.
Anchor Packing Co., 401 N. Broad St., Philadelphia, Pa.
Anchor Stove & Range Co., Third & Culbertson Sts., New Albany, Ind.
Andersen Corp., Bayport, Minn.
●Anderson Co., V. D., The, 1949 W. 96th St., Cleveland, O.
Anderson Engine & Foundry Co., Anderson, Ind.
Anderson Mfg. Co., 511 Third, Des Moines, Ia.
Anderson Products, Inc., 17 Tudor St., Cambridge, Mass.
Anemostat Corp. of America, 10 E. 39th St., New York, N. Y.
Anetsberger Bros., 3505 Elston Ave., Chicago, Ill.
Annis Air Filters, 1515 Gardena St., Glendale, Cal.
Ansul Chemical Co., Marinette, Wis.
Apex Rotarex Corp., 1070 E. 152nd St., Cleveland, O.
Apollo Steel Co., 609 Warren Ave., Apollo, Pa.
April Showers Co., 4126 Eighth St., N.W., Washington, D. C.
Aqua-Sorb Co., 21 S. 16th St., East Orange, N. J.
Aquatic Chemical Laboratories, Inc., 95 Liberty St., New York, N. Y.
Arcos Corp., 401 N. Broad St., Philadelphia, Pa.
Arcweld Mfg. Co., Inc., 3469 Third Ave., W., Seattle, Wash.
Arex Co., 333 N. Michigan Ave., Chicago, Ill.
Armour Ammonia Works, 1355 W. 31st St., Chicago, Ill.
Armstrong Bros. Tool Co., 317-357 N. Francisco Ave., Chicago, Ill.
Armstrong Co., The, Post Ave. and South St., Detroit, Mich.
●Armstrong Cork Co., 994 Concord St., Lancaster, Pa.
Armstrong Heat Control Co., 1626 N.E. Union Ave., Portland, Ore.
●Armstrong Machine Wks., 874 Maple St., Three Rivers, Mich.
Armstrong Mfg. Co., 303 Knowlton St., Bridgeport, Conn.
Armstrong-Blum Mfg. Co., 5700 Bloomingdale Rd., Chicago, Ill.
Arrow-Hart & Hegeman Elect. Co., 103 Hawthorn St., Hartford, Conn.
Ashcroft Gauge Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Ashton Valve Co., 161-1st St., Cambridge, Mass.
Askania Regulator Co., 1605 S. Michigan Ave., Chicago, Ill.
Asphalt Products Co., Eastwood Sta., Syracuse, N. Y.
Athey Co., 6035-43 W. 65th St., Chicago, Ill.
Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York, N. Y.
Atlantic Steel Boiler Co., 21st St. and Washington Ave., Philadelphia, Pa.
Atlas Chemical Co., Marietta, O.
Atlas Heating & Ventilating Co., Ltd., 557 Fourth St., San Francisco, Cal.
Atlas Valve Co., Inc., 282 South St., Newark, N. J.
Auburn Foundry Inc., Stoker Div., Auburn, Ind.
Auditorium Conditioning Corp., 17 E. 42nd St., New York, N. Y.
●Auer Register Co., 3608 Payne Ave., Cleveland, O.
Aurora Pump Co., 619 Loucks St., Aurora, Ill.
Austin-Mason Co., 15 Park Row, New York, N. Y.
Au-Temp-Co Corp., 1 Park Ave., New York, N. Y.
Autoforce Ventilating System, 53 Devonshire St., Boston, Mass.
Automatic Control Co., 1005 University Ave., St. Paul, Minn.
Automatic Gas Equipment Co., 301 Brushton Ave., Pittsburgh, Pa.
●Automatic Products Co., 2460 N. 32nd St., Milwaukee, Wis.
Automatic Pump & Softener Corp., 1907 Kishwaukee St., Rockford, Ill.
Automatic Stoker Corp., 2427 W. North Ave., Milwaukee, Wis.
Automatic Switch Co., 41 E. 11th St., New York, N. Y.
Automatic Temperature Control Co., Inc., 33 E. Logan St., Philadelphia, Pa.
Automotive Maintenance Machinery Co., North Chicago, Ill.
Autovent Fan & Blower Co., 1811-27 N. Kostner Ave., Chicago, Ill.
Azor Corp., Newark, N. J.

B

Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.
Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.
Bache & Co., Semon, Greenwich & Morton Sts., New York, N. Y.
Badger & Sons Co., E. B., 75 Pitts St., Boston, Mass.
Badger Fire Extinguisher Co., 31 St. James Ave., Boston, Mass.
Baer Bros., 438 W. 37th St., New York, N. Y.
Bahnson Co., R. J., Reynolds Bldg., Winston-Salem, N. C.
Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.
●Baker Ice Machine Co., Inc., 1508 Evans St., Omaha, Nebr.
Baldor Electric Co., 4353 Duncan Ave., St. Louis, Mo.
Baldwin-Hill Co., 527 Klagg Ave., Trenton, N. J.
Ballantyne Co., 222 N. 16th St., Omaha, Nebr.
Balloffet Dies and Nozzle Co., Inc., 45-51 Adams St., Guttenberg, N. J.
Barber Asphalt Corp., Barber, N. J.
Barber Gas Burner Co., 3704 Superior Ave., Cleveland, O.
Barber-Colman Co., 225 Loomis St., Rockford, Ill.
Barclay, Inc., Robert, 128 N. Peoria St., Chicago, Ill.
Barco Mfg. Co., 1801 Winnemac Ave., Chicago, Ill.
Bardco Corp. of America, 6670 Lexington Ave., Los Angeles, Cal.
Barium Stainless Steel Corp., 1502 Allen Ave., S. E., Canton, O.
Barland Weatherstrip Material Co., 5600 Curtis Ave., Cleveland, O.
Barnes Co., W. F. & John, Rockford, Ill.
Barnes & Jones, Inc., 128 Brookside Ave., Jamaica Plain, Boston, Mass.
Barnes Tool Co., The, 152 Brewery St., New Haven, Conn.
Barrett Co., The, 40 Rector St., New York, N. Y.
Barrett, Haentjens & Co., Hazleton, Pa.
Barrett Machine Co., 912-916 Behan St., N. S., Pittsburgh, Pa.
Bartlett Hayward Co., 200 Scott St., Baltimore, Md.
Bartlett Mfg. Co., 3003 E. Grand Blvd., Detroit, Mich.
Bass Foundry & Machine Co., 1602-1734 Hanna St., Ft. Wayne, Ind.
Bastian-Blessing Co., 240 E. Ontario St., Chicago, Ill.
Bausch & Lomb Optical Co., 635 St. Paul St., Rochester, N. Y.
Bayer Co., 4030 Chouteau Ave., St. Louis, Mo.
Bayley Blower Co., 1817 S. 66th St., Milwaukee, Wis.
Beach-Russ Co., 64A Church St., New York, N. Y.
●Beacon-Morris Corp., 702 Beacon St., Boston, Mass.
Bear Mfg. Co., Rock Island, Ill.
Bearings Co. of America, 501 Harrisburg Ave., Lancaster, Pa.
Beaton & Cadwell Mfg. Co., 185 Main St., New Britain, Conn.
Beaton & Corbin Mfg. Co., Southington, Conn.
Beatty Machine & Mfg. Co., 934 150th St., Hammond, Ind.
Beaver Pipe Tools, Inc., Keeney Ave., Warren, O.
Beck Engineering Combustion Kompany, 3033 Spruce St., St. Louis, Mo.
Beckley Perforating Co., 315 North Ave., Garwood, N. J.
Belanger Fan & Blower Co., 1230 18th St., Detroit, Mich.
Belco Exhaust Fan Mfg. Co., 3810 Olive St., St. Louis, Mo.
Belfield Co., H., 435 N. Broad St., Philadelphia, Pa.
Belknap Mfg. Co., 800 Union Ave., Bridgeport, Conn.
●Bell & Gossett Co., 3000 Wallace St., Chicago, Ill.
Belmont Packing & Rubber Co., Butler & Sepviva Sts., Philadelphia, Pa.
Belmont Smelting & Refining Wks., Inc., 349 Belmont Ave., Brooklyn, N. Y.
Bender Warrick Corp., 131 Pierce, Birmingham, Mich.
Benjamin Air Rifle Co., 1527 S. 8th St., St. Louis, Mo.
Benjamin Electric Mfg. Co., Des Plaines, Ill.
Bennett Co., 1109 Harney St., Omaha, Nebr.
Benson Co., Inc., Alex R., 1040 Bay Rd., So. Hudson, N. Y.
Berger Bros. Co., 229-237 Arch St., Philadelphia, Pa.
Berger Mfg. Div., Republic Steel Corp., 1038 Belden Ave., Canton, O.
Berns Specialty Co., 1015 Lake St., Chicago, Ill.
Bernz Co., Inc., Otto, 280 Lyell Ave., Rochester, N. Y.
Berry, Jr., & Co., Inc., F. E., Everett, Mass.
Bertsch & Co., Inc., Church St., Cambridge City, Ind.
Best Register Co., 2005 W. Oklahoma Ave., Milwaukee, Wis.
Bethlehem Foundry & Machine Co., W. Second St., Bethlehem, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Betz Air Conditioning Corp., 1820 Wyandotte St., Kansas City, Mo.
Betz Corp., 460 State St., Hammond, Ind.
Beverly Throatless Shear Co., 3009 W. 110th Pl., Chicago, Ill.
Bien Air Conditioning Co., Bell, Calif.
Bigelow Co., 92 River St., New Haven, Conn.
Biggs Boiler Wks. Co., Case Ave. & B. & O. R. R., E. Akron, O.
Bignall & Keeler Machine Wks., Edwardsville, Ill.
Billings & Spencer Co., 1 Laurel St., Hartford, Conn.
Binkley Mfg. Co., Warrenton, Mo.
●Binks Mfg. Co., 3114-40 Carroll Ave., Chicago, Ill.
Bird-Archer Co., 90 West St., New York, N. Y.
●Bishop & Babcock Mfg. Co., 4901 Hamilton Ave., Cleveland, O.
Black & Decker Mfg. Co., Pennsylvania Ave., Towson, Md.
Blackhawk Mfg. Co., 5325 W. Rogers St., Milwaukee, Wis.
Blackmer Pump Co., 1809A Century Ave., S. W., Grand Rapids, Mich.
Blaisdell Compressor Co., 227 Fulton St., New York, N. Y.
Bliss Co., E. W., 1420 Hastings St., Toledo, O.
Blocksom & Co., E. 5th St., Michigan City, Ind.
Blood Brothers, Allegan, Mich.
Blower Application Co., 918 N. Fourth St., Milwaukee, Wis.
Blue Seal Chemical Co., 177 Westfield Ave., W., Roselle Park, N. J.
Bluffton Mfg. Co., The, 433 W. Main Cross St., Findlay, O.
Bodine Electric Co., 2254 W. Ohio St., Chicago, Ill.
Boester, Carl F., 101 E. Essex—Kirkwood, St. Louis, Mo.
Bogue Electric Co., 80 Glover Ave., Paterson, N. J.
Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Boiler Room Equipment, Inc., 45 W. 45th St., New York, N. Y.
Bonney Forge & Tool Wks., Tilghman St. & Meadow St., Allentown, Pa.
Bordo Co., Inc., L. J., 115 New St., Glenside, Pa.
Boston Auto Gage Co., 70 West St., Pittsfield, Mass.

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Boston Gear Works, Inc., North Quincy, Mass.
Boston Woven Hose & Rubber Co., Broadway, Cambridge, Mass.
Bostwick-Goodell Co., Norwalk, O.
Bowser & Co., Inc., S. F., 1302 E. Creighton Ave., Fort Wayne, Ind.
Boylston Steam Specialty Co., 116-122 W. Illinois St., Chicago, Ill.
Brasco Mfg. Co., Harvey, Ill.
Brauer Supply Co., A. G., 2100 Washington Ave., St. Louis, Mo.
Bremil Mfg. Co., Box 1030, Erie, Pa.
Bridgeport Brass Co., E. Main St., Bridgeport, Conn.
Bridgeport Thermostat Co., Connecticut Ave., Bridgeport, Conn.
Briggs & Stratton Co., 2711 N. 13th St., Milwaukee, Wis.
Bristol Co., The, Waterbury, Conn.
Brooke Engineering Co., Inc., 4517 Wayne Ave., Philadelphia, Pa.
Bros Boiler & Mfg. Co., Wm., Nicollet Island, Minneapolis, Minn.
Brown Fintube Co., The, Elyria, O.
Brown Instrument Co., Div. of Minneapolis-Honeywell Regulator Co., 4534 Wayne Ave., Philadelphia, Pa.
Brown-Brockmeyer Co., Inc., 1098 Smithville Rd., Dayton, O.
Brownell Co., 300 N. Findlay St., Dayton, O.
Brown-Ford Corp., Newton, Mass.
Browning Mfg. Co., Inc., 1940 Browning Blvd., Maysville, Ky.
Brundage Co., 500-514 N. Park St., Kalamazoo, Mich.
Bruning Co., Inc., Charles, 42-33 Ninth St., Long Island City, N. Y.
Brunner Mfg. Co., 1821 E. Broad St., Utica, N. Y.
Bryan Steam Corp., P. O. Box 337, Peru, Ind.
Bryant Heater Co., The, 17825 St. Clair Ave., Cleveland, O.
Bubar, Hudson H., 15 Park Row, New York, N. Y.
Buda Co., Harvey, Ill.
●Buffalo Forge Co., 171 Mortimer St., Buffalo, N. Y.
Buffalo Meter Co., 2917 Main St., Buffalo, N. Y.
●Buffalo Pumps, Inc., 171 Mortimer St., Buffalo, N. Y.
Buffalo Tank Co., Arlington, Staten Island, N. Y.
Builders Iron Foundry, 9 Codding St., Providence, R. I.
Bullard Co., The, 286 Canfield Ave., Bridgeport, Conn.
Bundy Steam Trap Co., Nashua, N. H.
Bundy Tubing Co., 10951 Hern, Detroit, Mich.
Burdett Mfg. Co., 19 N. Loomis St., Chicago, Ill.
Burhorn Co., Edwin, 554 W. 48th St., New York, N. Y.
Burke Electric Co., 1201 W. 12th St., Erie, Pa.
Burke Stoker & Mfg. Co., 921 W. 19th St., Chicago, Ill.
Burling Instrument Co., Air Conditioning Div., 253 Springfield Ave., Newark, N. J.
●Burnham Boiler Corp., Main St., Irvington, N. Y.
Burnham Stoker Co., 505 Columbia St., Vancouver, Wash.
Burnley Battery & Mfg. Co., Clay St., North East, Pa.
Burrows Mfg. Co., F. A., 318 E. Poplar St., York, Pa.
Burt Mfg. Co., 635 Main St., Akron, O.
Bury Compressor Co., 18th & Cascade Sts., Erie, Pa.
Bush Mfg. Co., 100 Wellington St., Hartford, Conn.
Butler Street Foundry & Iron Co., 3422 Normal Ave., Chicago, Ill.
Butterworth, B. T., Jr., New Canaan, Conn.
●Byers Co., A. M., Clark Bldg., Pittsburgh, Pa.
Byron Jackson Co., P. O. Box 2017, Terminal Annex, Los Angeles, Cal.

C

Cabot, Inc., Samuel, 141 Milk St., Boston, Mass.
Calbar Paint & Varnish Co., 2612-26 N. Martha St., Philadelphia, Pa.
Caldwell Co., W. E., 2120 Brook St., Louisville, Ky.
California Cornice, Steel & Supply Corp., 1620 N. Spring St., Los Angeles, Cal.
Callahan Can Machine Co., Inc., 80 Richard St., Brooklyn, N. Y.
Caloroil Burner Corp., 1477 Park St., Hartford, Conn.
Campbell Heating Co., E. K., 2445 Charlotte St., Kansas City, Mo.
Campbell Heating Co., 31st & Dean, Des Moines, Ia.
Canatsey Electric Mfg. Co., 620 Wyandotte St., Kansas City, Mo.
Cannon Chemical Co., 210 Broadway, Everett, Mass.
Canton Stoker Corp., 407 Andrews Place, S. W., Canton, O.
Canvas Products Co., 1236 S. 7th St., St. Louis, Mo.
Capitol Brass Works, Div. of Bohn Aluminum & Brass Corp., 2306 Franklin St., Detroit, Mich.
Carbide and Carbon Chemicals Corp., 30 E. 42nd St., New York, N. Y.
●Carbondale Div., Worthington Pump & Machinery Corp., Harrison, N. J.
●Carey Co., Philip, Wayne Ave., Lockland, Cincinnati, O.
Carling Turbine Blower Co., 25 St. John's Rd., Worcester, Mass.
●Carnegie-Illinois Steel Corp., Carnegie Bldg., Pittsburgh, Pa.
Carnes, Inc., John R., Greenlawn Ave. & Erie R. R., Lima, O.
Carney Rockwool Co., Mankato, Minn.
Carpenter & Co., Geo. B., 440 N. Wells St., Chicago, Ill.
Carpenter & Paterson, Inc., 1190 Bennington St., East Boston, Mass.
Carpenter Steel Co., Reading, Pa.
●Carrier Corp., 302 S. Geddes St., Syracuse, N. Y.
Carty & Moore Engineering Co., 511 W. Larned St., Detroit, Mich.
Case & Son Mfg. Co., W. A., 33 Main St., Buffalo, N. Y.
●Cash Co., A. W., P. O. Box 135, Decatur, Ill.
Cash Universal Regulator Co., Marshalltown, Ia.
Cashin Co., W. D., 69 A St., Boston, Mass.
Caterpillar Tractor Co., 600 W. Washington St., Peoria, Ill.
Celotex Corp., The, 919 N. Michigan Ave., Chicago, Ill.
Central Brass Mfg. Co., 2950 E. 55th St., Cleveland, O.
Central Die Casting & Mfg. Co., Inc., 2935 W. 47th St., Chicago, Ill.
Central Forging Co., Catawissa, Pa.
Central Foundry Co., 386 Fourth Ave., New York, N. Y.
●Central Station Steam Co., 2920 E. Woodbridge St., Detroit, Mich.
Central Valve Mfg. Co., 255 E. 95th St., Chicago, Ill.
Central Wire & Iron Works, 621 E. Locust St., Des Moines, Ia.
Centrifix Corp., 3029 Prospect Ave., Cleveland, O.
●Century Electric Co., 1806 Pine St., St. Louis, Mo.
Century Engineering Corp., 401-431 3rd St., S. E., Cedar Rapids, Ia.
Century Fan & Ventilator Co., 292 Locust Ave., New York, N. Y.
Certain-teed Products Corp., 100 E. 42nd St., New York, N. Y.
Certified Flexible Couplings, Inc., 122 E. 42nd St., New York, N. Y.
Certified Products Co., 2014 N. 14th St., Toledo, O.
Chace Co., W. M., 1606 Beard Ave., Detroit, Mich.
Chain Belt Co., 1644 W. Bruce, Milwaukee, Wis.
Chain Tape Venetian Blind Co., Rockford, Ill.
Chalmers Oil Burner Co., 1234 Central Ave., Minneapolis, Minn.
Chamberlin Metal Weather Strip Co., 1254 La Brosse St., Detroit, Mich.
Champion Blower & Forge Co., Harrisburg Ave. and Charlotte St., Lancaster, Pa.
Champion Furnace Pipe Co., 918 S. Adams St., Peoria, Ill.
Champion Machine & Forging Co., 3678 E. 78th St., Cleveland, O.
Champion Unit Heater Co., 4639-41 Washington Blvd., Chicago, Ill.
Chandler Co., 804 First Ave., N. W., Cedar Rapids, Ia.
Chaplin-Fulton Mfg. Co., 28-40 Penn Ave., Pittsburgh, Pa.
Chapman Valve Mfg. Co., The, Indian Orchard, Mass.
Char-Gale Mfg. Co., 3127 Hiawatha Ave., Minneapolis, Minn.
Chase Brass & Copper Co., Inc., 236 Grand St., Waterbury, Conn.
Chelsea Fan & Blower Co., 370 W. 15th St., New York, N. Y.
Chelsea Metal Stamping Co., 95 8th Ave., New York, N. Y.
Cheney Co., Architects' Bldg., Philadelphia, Pa.
Chesapeake & Ohio R.R. Co., Terminal Tower, Cleveland, O.
Chicago Belting Co., 113-125 N. Green St., Chicago, Ill.
Chicago Bridge & Iron Co., 332 S. Michigan Ave., Chicago, Ill.
Chicago Die Casting Mfg. Co., 2515 W. Monroe St., Chicago, Ill.
Chicago Expansion Bolt Co., 126 S. Clinton St., Chicago, Ill.
Chicago Filter Co., Joliet, Ill.
Chicago Fire Brick Co., 1467 N. Elston Ave., Chicago, Ill.
Chicago Furnace Supply Co., 1278 Clybourn Ave., Chicago, Ill.
Chicago Metal Hose Corp., Maywood, Ill.
Chicago Metal Mfg. Co., 3724 S. Rockwell St., Chicago, Ill.
Chicago Nipple Mfg. Co., 1966 Southport Ave., Chicago, Ill.
Chicago Perforating Co., 2445 W. 24th Pl., Chicago, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Chicago Pump Co., 2336 Wolfram St., Chicago, Ill.
Chicago Specialty Mfg. Co., 332 N. Western Ave., Chicago, Ill.
Chicago Steel & Wire Co., 103rd St. and Torrence Ave., Chicago, Ill.
Chicago Venetian Blind Co., 3917 S. Michigan Ave., Chicago, Ill.
Chicago-Wilcox Mfg. Co., E. 77th St. and Anthony Ave., Chicago, Ill.
Chisholm Co., Allen E., 2640 E. Burnside St., Portland, Ore.
Cincinnati Electrical Tool Co., The, 2684 Madison Rd., Cincinnati, O.
Cincinnati Mfg. Co., Gest and Evans Sts., Cincinnati, O.
Cincinnati Shaper Co., Hopple, Garrard & Elam, Cincinnati, O.
Cincinnati Sheet Metal & Roofing Co., 230 E. Front St., Cincinnati, O.
Circulators & Devices Mfg. Corp., 100 Prince St., New York, N. Y.
Cissell Mfg. Co., W. M., 831 S. First St., Louisville, Ky.
●Clarage Fan Co., Porter St., Kalamazoo, Mich.
Clark Bros. Bolt Co., Milldale, Conn.
Clark Controller Co., 1146 E. 152nd St., Cleveland, O.
Clark Cooper Co., 159 Jefferson St., Philadelphia, Pa.
Clark Dust Control Co., 210 N. Mozart St., Chicago, Ill.
Clark Jr., Electric Co., Jas., 600 Bergman St., Louisville, Ky.
Clauss Shear Co., Fremont, O.
Clay Equipment Corp., Cedar Falls, Ia.
Clayton & Lambert Mfg. Co., 11111 French Rd., Detroit, Mich.
Cleaver-Brooks Co., 3112 W. Center St., Milwaukee, Wis.
Clees Valve & Engineering Co., 90 West St., New York, N. Y.
Cleghorn Co., 86 Broad St., Boston, Mass.
Clendenin Bros., Inc., 108 South St., Baltimore, Md.
Cleveland Punch & Shear Works Co., E. 40th and St. Clair Ave., Cleveland, O.
●Clifford Mfg. Co., 564 E. First St., Boston, Mass.
Clinton Metallic Paint Co., P. O. Box 278, Clinton, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 282.

Clizbe Bros. Mfg. Co., Plymouth, Ind.
Clow & Sons, James B., 201-299 N. Talmon Ave., Chicago, Ill.
●Cochrane Corp., 3161 N. 17th St., Philadelphia Pa.
Coe Mfg. Co., Bank St., Painesville, O.
Cohoes Rolling Mill Co., Canvass and Cortland Sts., Cohoes, N. Y.
Colebrook & Sons, Inc., W. H., 246 Walton St., Syracuse, N. Y.
Cole-Sullivan Engineering Co., 1316 Third St., N., Minneapolis, Minn.
Colonial Alloys Co., Metals Div., E. Somerset, Trenton Ave. and Reading R. R., Philadelphia, Pa.
Columbia Mills, Inc., Saginaw, Mich.
Columbia Radiator Co., 3400 Walnut St., McKeesport, Pa.
●Columbia Steel Co. (Sub. United States Steel Corp.), Russ Bldg., 235 Montgomery St., San Francisco, Cal.
Columbia Vari-Speed Co., Liberty Bldg., Wheaton, Ill.
Columbian Steel Tank Co., 1509 W. 12th St., Kansas City, Mo.
Columbus Heating & Ventilating Co., 182 N. Yale Ave., Columbus, O.
Columbus Metal Products, Inc., 767 N. 4th St., Columbus, O.
Columbus Steam Pump Wks. Co., 724 W. Gay St., Columbus, O.
Combination Boiler Co., Benton Harbor, Mich.
Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y.
●Commercial Shearing & Stamping Co., 1775 Logan, Youngstown, O.
Commodore Heaters Corp., 11 W. 42nd St., New York, N. Y.
Commonwealth Brass Corp., 5781-5835 Commonwealth Ave., Detroit, Mich.
Commonwealth Electric Welder Mfg. Co., 3200-F W. Oxford St., Philadelphia, Pa.
Conditionaire Unit Co., 2821 Montrose Ave., Chicago, Ill.
Congress Die Casting Div., Congress Tool & Die Co., 3750 E. Outer Drive, Detroit, Mich.
Conneaut Packing Co., Conneaut, O.
Connery Construction Co., 2nd and Luzerne Sts., Philadelphia, Pa.
●Connor Engineering Corp., W. B., Dorex Div., 114 E. 32nd St., New York, N. Y.
Consolidated Car-Heating Co., Inc., Albany, N. Y.
Consolidated Safety Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.
Continental Diamond Fibre Co., Newark, Del.
Continental Electric Co., Inc., 323 Ferry St., Newark, N. J.
Continental Motors Corp., Muskegon, Mich.
Continental Products Co., 1150 E. 222nd St., Euclid, O.
Continental Rubber Wks., 1905 Liberty Blvd., Erie, Pa.
Continental Steel Corp., 1108 S. Main St., Kokomo, Ind.
Continental Stove Corp., Front and Walnut Sts., Ironton, O.
Cook, Inc., A. D., Lawrenceburg, Ind.
Cook Electric Co., 2700 Southport Ave., Chicago, Ill.
Coolmaster Corp., 530 S. Dearborn St., Chicago, Ill.
Cooper Co., Clark, 159 Jefferson St., Philadelphia, Pa.
Cooper Sanitary Co., 3316 Race St., Philadelphia, Pa.
Copeland Refrigeration Corp., Sidney, O.
Coppus Engineering Corp., 374 Park Ave., Worcester, Mass.
Corbman Bros., Inc., 1205 N. Fourth St., Philadelphia, Pa.
●Cork Import Corp., 330 W. 42nd St., New York, N. Y.
Cork Insulation Co., Inc., 155 E. 44th St., New York, N. Y.
Corley Co., 629 Grove St., Jersey City, N. J.
Corning Glass Works, Corning, N. Y.
Corozone Air Conditioning Corp., 1422 Euclid Ave., Cleveland, O.
Cramer Co., Inc., R. W., The, Centerbrook, Conn.
●Crane Co., 836 S. Michigan Ave., Chicago, Ill.
Crane Packing Co., 1801 Belle Plaine Ave., Chicago, Ill.
Crawford Co., 3220 W. 31st St., Chicago, Ill.
Crescent Tool Co., 230 Harrison St., Jamestown, N. Y.
Crise Elec. Mfg. Co., 14-16 E. Ohio Ave., Mt. Vernon, O.
Crocker-Wheeler Electric Mfg. Co., Ampere, N. J.
Croll & Son, Jesse G., 2326-2606 Germantown Ave., Philadelphia, Pa.
Croll-Reynolds Engineering Co., Inc., 17 Johns St., New York, N. Y.
Cross Engineering Co., 160-178 Dundaff St., Carbondale, Pa.
Crown Cork & Seal Co., 4401 Eastern Ave., Baltimore, Md.
Crown Die & Tool Co., 267 N. California Ave., Chicago, Ill.
Crown Iron Works, 1229 N. E. Tyler, Minneapolis, Minn.
Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.
Cryer Trap & Valve Co., Inc., 366 Madison Ave., New York, N. Y.
Crystal Refrigerator Co., Fremont, Nebr.
Cugley Incubator Co., Elkhart, Ind.
Cuno Engineering Corp., 80 S. Vine St., Meriden, Conn.
Curtis & Curtis Co., 450 Garden St., Bridgeport, Conn.
●Curtis Refrigerating Machine Co., 1950 Kienlen Ave., St. Louis, Mo.
Cutler-Hammer, Inc., N. 12th St. and W. St. Paul Ave., Milwaukee, Wis.
Cyrus Shank Co., 625 W. Jackson Blvd., Chicago, Ill.

D

D & M Mfg. Co., 51 Lincoln Ave., Midland Park, N. J.
Dahlquist Mfg. Co., Inc., 40 W. 3rd St., Boston, Mass.
Dallas Engineering Co., Inc., 1115 Hall, Dallas, Tex.
Dampney Co. of America, 1243 River St., Hyde Park, Boston, Mass.
Darcoid Co., Inc., 145 Sixth Ave., New York, N. Y.
Darling Valve & Mfg. Co., 701 First St., Williamsport, Pa.
●Dart Mfg. Co., E. M., 134 Thurber Ave., Providence, R. I.
Davidson Co., M. T., 154 Nassau St., New York, N. Y.
Davidson Hy Duty Roof Fan Co., 213 California St., Newton, Mass.
Davies Air Filter Corp., 390 Fourth Ave., New York, N. Y.
Davis Engineering Corp., 1064 E. Grand St., Elizabeth, N. J.
Davis Regulator Co., 2546 S. Washtenaw Ave., Chicago, Ill.
Day Co., The, 2938 Pillsbury Ave., Minneapolis, Minn.
Dayton Air Compressor Co., Dayton, O.
Dayton Rubber Mfg. Co., 2345 W. Riverview Ave., Dayton, O.
Dayton-Dowd Co., 115-17 York St., Quincy, Ill.
●Dean Bros. Co., 323 W. 10th St., Indianapolis, Ind.
Dean Hill Pump Co., Anderson, Ind.
Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.
Debevoise Co., The, 968 Grand Ave., Brooklyn, N. Y.
De Bothezat Ventilating Equipment Div., American Machine & Metals, Inc., East Moline, Ill.
Decatur Iron & Steel Co., Decatur, Ala.
Decatur Pump Co., 2750 Nelson Park Rd., Decatur, Ill.
Defender Automatic Regulator Co., 308 S. 8th St., St. Louis, Mo.
De Laval Steam Turbine Co., 300 Nottingham Way, Trenton, N. J.
De La Vergne Engine Co., Philadelphia, Pa.
Delco Appliance Co., Rochester, N. Y.
Delco Products Corp., 329 E. First St., Dayton, O.
Delta Stoker Co., Foot of Commonwealth, North Chicago, Ill.
Delta-Star Electric Co., 2400 Block, W. Fulton St., Chicago, Ill.
Deming Co., 14 Aetna St., Salem, O.
Demuth & Sons, Charles, 112-07 New York Blvd., Jamaica, N. Y.
Desmond-Stephan Mfg. Co., Urbana, Ill.
Desolvo Co., The, 31 Terminal Way, Pittsburgh, Pa.
Despatch Oven Co., 600 Ninth St., S. E., Minneapolis, Minn.
Detroit Air Meter Co., Box 1473, Detroit, Mich.
Detroit Brass & Malleable Works, 100 S. Campbell, Detroit, Mich.
Detroit Graphite Co., 550 12th St., Detroit, Mich.
●Detroit Lubricator Co., 5900 Trumbull Ave., Detroit, Mich.
Detroit Seamless Steel Tubes Co., c/o Grand River Station, Detroit, Mich.
Detroit Stamping Co., 350 Midland Ave., Detroit, Mich.
Detroit Steel Products Co., 2250 E. Grand Blvd., Detroit, Mich.
Detroit Stoker Co., Sales and Engineering Offices, General Motors Bldg., Detroit, Mich.; Works at Monroe, Mich.
Detroit Stoker Co. of Canada, Ltd., Canada Bldg., Windsor, Ont.; Works at London, Ont.
DeVilbiss Co., The, 300 Phillips Ave., Toledo, O.
Devine Mfg. Co., Inc., J. P., 909 Shawnee Ave., Mt. Vernon, Ill.
Devlin Mfg. Co., Inc., Thomas, Burlington, N. J.
Diamond Chain & Mfg. Co., 400 Kentucky Ave., Indianapolis, Ind.
Diamond Expansion Bolt Co., Inc., 500 North Ave., Garwood, N. J.
Diamond Mfg. Co., 253 W. Eighth St., Wyoming, Pa.
Diamond Metal Weather Strip Co., 650 N. Fourth St., Columbus, O.
Diamond Power Specialty Corp., 10340 Oakland, Detroit, Mich.
Dick Co., Inc., R. & J., 24-48 Sade St., Passaic, N. J.
Diehl Mfg. Co., Trumbull St., Elizabethport, N. J.
Dillon Steam Boiler Wks., Inc., D. M., Crocker St., Fitchburg, Mass.
Dissolene Corp., Hempstead, N. Y.
Dixon Crucible Co., Joseph, Wayne & Monmouth Sts., Jersey City, N. J.
Dockson Corp., 3847 Wabash Ave., Detroit, Mich.
Dockstader, S. E., 1128 Munsey Bldg., Washington, D. C.
Dodge Mfg. Corp., 500 S. Union St., Mishawaka, Ind.
Doheny Co., John J., 326 Lake St., Belmont, Mass.
●Dole Valve Co., The, 1901-41 Carroll Ave., Chicago, Ill.
Domestic Engine & Pump Co., Shippensburg, Pa.
Dow Chemical Co., Midland, Mich.
Downingtown Iron Wks., Wallace Ave., Downingtown, Pa.
Downs-Smith Brass & Copper Co., 304-320 E. 45th St., New York, N. Y.
Dracco Corp., 4057 E. 116th St., Cleveland, O.
Dragert Co., Inc., C. H., 237 India St., Brooklyn, N. Y.
Dravo Corp., Dravo Bldg., Pittsburgh, Pa.
Drayer & Hanson, Inc., 738 E. Pico Blvd., Los Angeles, Cal.
Dreis & Krump Mfg. Co., 7404 Loomis Blvd., Chicago, Ill.
Dresser Mfg. Co., 490 Fisher Ave., Bradford, Pa.
Dry-Zero Corp., Merchandise Mart, Chicago, Ill.
●Dunham Co., C. A., 450 E. Ohio St., Chicago, Ill.
Dunn, Inc., Struthers, 1332 Cherry St., Philadelphia, Pa.
du Pont de Nemours & Co., Inc., E. I., The, R. & H. Chemicals Dept., Wilmington, Del.
du Pont de Nemours & Co., E. I., National Ammonia Div., Frankford, Philadelphia, Pa.
du Pont de Nemours & Co., Inc., E. I., Fabrics & Finishes Dept., Wilmington, Del.
Durabla Mfg. Co., 114 Liberty St., New York, N. Y.
Durakool, Inc., 1010 N. Main St., Elkhart, Ind.
Duraloy Co., Scottdale, Pa.
Duriron Co., Inc., 450 N. Findlay St., Dayton, O.
Duro Co., 537 Monument Ave., Dayton, O.
Dustlix Corp., 715 N. Van Buren St., Milwaukee, Wis.
Dwyer Mfg. Co., F. W., 565 W. Washington Blvd., Chicago, Ill.

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Dyer Welder & Engineering Co., 7 E. 19th St., Kansas City, Mo.
Dynamic Welder Co., 2226 Silverton Rd., Chicago, Ill.

E

Eagle-Picher Lead Co., Temple Bar Bldg., Cincinnati, O.
Eastern Engineering Co., 45 Fox St., New Haven, Conn.
Eastern Foundry Co., Boyertown, Pa.
Eastern Foundry Co., Peerless Heater Div., Boyertown, Pa.
Easternoil, Inc., 133 Marginal Way, Portland, Me.
Eastman Kodak Co., Kodak Park, Rochester, N. Y.
●Eclipse Aviation, Div. of Bendix Aviation Corp., Bendix, N. J.
Eclipse Fuel Engineering Co., 707 S. Main St., Rockford, Ill.
Econocol Stoker Div. of Cotta Transmission Corp., 2340 11th St., Rockford, Ill.
Economy Electric Mfg. Co., 4606 W. 21st Pl., Chicago, Ill.
Economy Equipment Co., 223 N. Wolcott Ave., Chicago, Ill.
Economy Pumps, Inc., 2522 W. Congress St., Chicago, Ill.
Eddy Stoker Corp., 4717 W. North Ave., Chicago, Ill.
Eddy Valve Co., Waterford, N. Y.
Edge Moor Iron Wks., Inc., 30 Rockefeller Plaza, New York, N. Y.
Edison, Inc., Thomas A., Edison Electrical Controls Div., Lakeside Ave., West Orange, N. J.
Edward Valve & Mfg. Co., Inc., 1200 W. 145th St., East Chicago, Ind.
Edwards Mfg. Co., Inc., 337 Eggleston Ave., Cincinnati, O.
●Ehret Magnesia Mfg. Co., Valley Forge, Pa.
Eiker Mfg. Co., Ogallala, Nebr.
Eisler Engineering Corp., 754 S. 13th St., Newark, N. J.
Elastic Stop Nut Corp., 2330 Vauxhall Rd., Union, N. J.
Electric Air Heater Co., Division of American Foundry Equipment Co., 555 Byrkit St., Mishawaka, Ind.
Electric Arc Cutting & Welding Co., 152 Jelliff Ave., Newark, N. J.
Electric Auto-Lite Co., Moto Meter Gauge & Equipment Div., Caledonia & Gillette Sts., La Crosse, Wis.
Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, O.
Electric Machinery Mfg. Co., 1331 Tyler St., N. E., Minneapolis, Minn.
Electric Valve Mfg. Co., Inc., 68 Murray St., New York, N. Y.
Electrimatic Corp., 2100 Indiana Ave., Chicago, Ill.
Electroaire Corp., 1455-57 W. Congress St., Chicago, Ill.
Electrol, Inc., 934 Main Ave., Clifton, N. J.
Electrovent Fan & Mfg. Co., 812 W. Lake St., Chicago, Ill.
Elgin Softener Corp., Elgin, Ill.
Elgo Shutter & Mfg. Co., 6970 W. Jefferson Ave., Detroit, Mich.
Elliott Co., Jeannette, Pa.
Ellis Drier Co., 2444 N. Crawford Ave., Chicago, Ill.
Ellison Draft Gage Co., 214 W. Kinzie St., Chicago, Ill.
Elsey Metal Specialties Co., 1535 Spruce St., Detroit, Mich.
Emerson Electric Mfg. Co., 1847 Washington Ave., St. Louis, Mo.
Empire Sheet & Tin Plate Co., N. Bowman St., Mansfield, O.
Endura Mfg. Corp., 45 N. 4th St., Quakerstown, Pa.
Engelhard, Inc., Charles, 90 Chestnut St., Newark, N. J.
Engineer Co., 75 West St., New York, N. Y.
Enterprise Oil Burner Co., 2949 18th St., San Francisco, Cal.
Erdle Perforating Co., 171 York St., Rochester, N. Y.
Ergolyte Mfg. Co., 3644 Lawrence St., Philadelphia, Pa.
Erie Bolt & Nut Co., Erie, Pa.
Erie City Iron Wks., 1450 East Ave., Erie, Pa.
Erie Tool Wks., 11th & French Sts., Erie, Pa.
Esko Mfg. Corp., 3409 McKinney, Houston, Tex.
Essick Mfg. Co., 1950 Santa Fe Ave., Los Angeles, Cal.
Everite Pump & Mfg. Co., Inc., Lancaster, Pa.
Everlasting Valve Co., 49 Fisk St., Jersey City, N. J.
Excelsior Leather Washer Co., 720-730 Chestnut St., Rockford, Ill.
Excelsior Steel Furnace Co., 118 So. Clinton St., Chicago, Ill.
Excelsior Tool & Machine Co., 31st & Ridge Ave., East St. Louis, Ill.

F

Fafnir Bearing Co., 37 Booth St., New Britain, Conn.
●Fairbanks Co., 396 Lafayette St., New York, N. Y.
Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago, Ill.
Fairmont Aluminum Co., Fairmont, W. Va.
Falstrom Co., Main Ave. & D. L. & W. R. R., Passaic, N. J.
Faraday Engrg. Co., 56 Clearway St., Back Bay, Boston, Mass.
Farley Sleeve & Hanger Co., 3748 E. 71st St., Cleveland, O.
Farquhar Co., Ltd., A. B., Duke St., York, Pa.
Farrar & Trefts, 9 Grimes St., Buffalo, N. Y.
●Fedders Mfg. Co., Inc., 57 Tonawanda St., Buffalo, N. Y.
Federal Machine & Welder Co., 212 Dana St., Warren, O.
Federal-Mogul Corp., 11031 Shoemaker St., Detroit, Mich.
Fee & Mason Mfg. Co., Inc., 81 Beekman St., New York, N. Y.
Fee and Stemwedel, Inc., 4949 N. Pulaski Rd., Chicago, Ill.
Felt Products Mfg. Co., 1514 Carroll Ave., Chicago, Ill.
Felters Co., Inc., 210 South St., Boston, Mass.
Ferguson & Lange Foundry Co., 1039 Willow St., Chicago, Ill.
Fern, Ralph, 2430 Boulevard Ave., Scranton, Pa.
Ferro-Enamel Corp., 4150 E. 56th St., Cleveland, O.
Ferro-Nil Corp., 373 Fourth Ave., New York, N. Y.
Filtrine Mfg. Co., Inc., 53 Lexington Ave., Brooklyn, N. Y.
Fingles, Inc., W. A., Reistertown Rd. at Elgin Ave., Baltimore, Md.
Firemood Machine Wks., Converse, Ind.
Firestone Tire & Rubber Co., S. Main St., Akron, O.
Fir-Tex Insulating Board Co., St. Helens, Ore.
●Fisher Governor Co., 205 S. First Ave., Marshalltown, Ia.
●Fitzgibbons Boiler Co., Inc., 101 Park Ave., New York N. Y.
Flagg & Co., Inc., Stanley G., 1421 Chestnut St., Philadelphia, Pa.
Flemm Lead Co., Inc., Bradley Ave. & School St., Long Island City, N. Y.
Flexitallic Gasket Co., 8th & Bailey Sts., Camden, N. J.
Flexo Supply Co., Inc., 4221 Olive St., St. Louis, Mo.
Flintkote Co., 30 Rockefeller Plaza, New York, N. Y.
Flori Pipe Co., The, 601 E. Red Bud Ave., St. Louis, Mo.
Fluor Corp., Ltd., The, 2500 S. Atlantic Blvd., Los Angeles, Cal.
Flynn & Emrich Co., 301 Holliday St., Baltimore, Md.
Follansbee Steel Corp., 3rd & Liberty Aves., Pittsburgh, Pa.
Ford Roofing Products Co., 111 W. Washington St., Chicago, Ill.
Forman Machine & Electric Corp., 550 Seventh Ave., New York, N. Y.
Forslund Pump & Machinery Co., 1717-19 Main St., Kansas City, Mo.
Foster Engineering Co., 109 Monroe St., Newark, N. J.
Foster Pump Wks., Inc., 46-A Washington St., Brooklyn, N. Y.
Foster Wheeler Corp., 165 Broadway, New York, N. Y.
Fowler & Wolfe Radiator Co., Oak & Carson Sts., Norristown, Pa.
Fox Control & Mfg. Co., 1785 Wayside Rd., Cleveland, O.
Foxboro Co., 106 Neponset Ave., Foxboro, Mass.
France Packing Co., 6512 Tacony St., Tacony, Philadelphia, Pa.
Frank Heaters, Inc., 150 Railroad Ave., Paterson, N. J.
Frederick Iron and Steel Co., E. 7th St., Frederick, Md.
Fresh-'nd Air Co., 210 N. Clinton St., Chicago, Ill.
Fretz-Moon Tube Co., Inc., Butler, Pa.
●Frick Co., Waynesboro, Pa.
Friez & Sons, Julien P., Div. of Bendix Aviation Corp., 4 N. Central Ave., Baltimore, Md.
Frigidaire Commercial & Air Conditioning Div., General Motors Sales Corp., Dayton, O.
Frost Mfg. Co., S. Henderson St., Galesburg, Ill.
Fuel Savers, Inc., 15th & Herr Sts., Harrisburg, Pa.
Fuelmiser Co., Inc., 938 Plymouth Bldg., Minneapolis, Minn.
Fulflo Specialties Co., Inc., The, Blanchester, O.
Fuller Co., 124 Bridge St., Catasauqua, Pa.
Fulton Sylphon Co., The, Knoxville, Tenn.
Furblo Co., Hermansville, Mich.

G

G. D. S. Machinery & Supply Co., Inc., 101 Walker St., New York, N. Y.
G. M. Mfg. Co., P. O. Box 151, Madison Square Sta., New York, N. Y.
●G & O Mfg. Co., 138 Winchester Ave., New Haven, Conn.
Gale Products, Galesburg, Ill.
Gallaher Boiler Co., 3615 LaClede Ave., St. Louis, Mo.
Garden City Fan Co., 332 S. Michigan Ave., Chicago, Ill.
Gardiner Metal Co., 2514 W. 48th Pl., Chicago, Ill.
Gardner-Denver Co., Quincy, Ill.
Garlock Packing Co., 50 Main St., Palmyra, N. Y.
Gas City Glass Co., Gas City, Ind.
Gasweld Equipment Co., 625 W. Jackson Blvd., Chicago, Ill.
Gates Rubber Co., 999 S. Broadway, Denver, Colo.
Gatke Corp., 228 N. La Salle St., Chicago, Ill.
Gehl Bros. Mfg. Co., West Bend, Wis.
Gehri Co., 1117 Tacoma Ave., Tacoma, Wash.
General Air Conditioning Corp., 4411 Appleton St., Cincinnati, O.
General Aire Co., 118 N. Sixth St., Philadelphia, Pa.
General Blower Co., Inc., 2402 Market St., Philadelphia, Pa.
General Blower Corp., 1450 Army St., San Francisco, Cal.
General Ceramics Co., 30 Rockefeller Plaza, New York, N. Y
●General Controls Co., 801 Allen Ave., Glendale, Cal.
●General Electric Co., Air Conditioning and Commercial Refrigeration Dept., 5 Lawrence St., Bloomfield, N. J.
General Electric Co., Lamp Dept., Nela Park, Cleveland, O.
General Electric Co., 1 River Rd., Schenectady, N. Y.
General Equipment Co., 315 S. Wichita, Wichita, Kans.
General Fittings Co., 123 Georgia Ave., Providence, R. I.
General Furnaces Corp., 17 State St., New York, N. Y.
General Gas Light Co., 212 N. Park, Kalamazoo, Mich.
General Insulating & Mfg. Co., 705 Olive St., St. Louis, Mo.
General Insulating Products Co., 8821 15th Ave., Brooklyn, N. Y.
General Machinery Co., 3500 Riverside Ave., Spokane, Wash.
General Motors Corp., Detroit, Mich.
General Plate Div., Metals & Controls Corp., 34 Forest St., Attleboro, Mass.
General Refrigeration Div., Yates-American Machine Co., Beloit, Wis.
General Regulator Corp., 2608 Arthington St., Chicago, Ill.
General Sales & Products Co., 242 Saratoga St., Cohoes, N. Y.
Gerett Corp., M. A., 2947 N. 30th St., Milwaukee, Wis.
Gerstein & Cooper Co., 1 W. Third St., South Boston, Mass.
Geuder, Paeschke & Frey Co., W. St. Paul Ave. and N. 15th St., Milwaukee, Wis.
Giant Grip Mfg. Co., 30 Osceola St., Oshkosh, Wis.
Giant Mfg. Co., South Ave., Council Bluffs, Ia.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Gillian Mfg. Co., 7752 Dubois St., Detroit, Mich.
●Gilmer Company, L. H., 7230 Keystone St., Tacony, Philadelphia, Pa.
Glaser Lead Co., Inc., 31 Wyckoff Ave., Brooklyn, N. Y.
Gleason-Avery, Inc., 27 Clark St., Auburn, N. Y.

● Advertisement in this issue. See Index to Advertisers, page 282.

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Glidden Co., 11001 Madison Ave., Cleveland, O.
Globe Machine & Stamping Co., 1220 W. 76th St., Cleveland, O.
Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.
Glore Sales Corp., Evins F., 1939 Grand Central Terminal Bldg., New York, N. Y.
Goese Mfg. Co., 2548 N. 18th St., Milwaukee, Wis.
Goethel Co., Alfred C., 2337 N. 31st St., Milwaukee, Wis.
Goethel Sheet Metal Wks., Alfred, 1910 N. Killian Pl., Milwaukee, Wis.
Goetze Gasket & Packing Co., Inc., 60 Allen Ave., New Brunswick, N. J.
Golden-Anderson Valve Specialty Co., Fulton Bldg., Pittsburgh, Pa.
Goldens' Foundry & Machine Co., Columbus, Ga.
Goodrich Co., B. F., 548 S. Main St., Akron, O.
Goodyear Tire & Rubber Co., E. Market St., Akron, O.
Gorton Heating Corp., Cranford, N. J.
Goulds Pumps, Inc., Fall St., Seneca Falls, N. Y.
Governair Corp., 605 W. Main St., Oklahoma City, Okla.
Grabler Mfg. Co., 6565 Broadway, Cleveland, O.
Grand Rapids Blow Pipe & Dust Arrester Co., 525-28 Monroe Ave., Grand Rapids, Mich.
Grand Rapids Die & Tool Co., 113-117 Michigan St., Grand Rapids, Mich.
Granite City Steel Co., 20th & Madison Ave., Granite City, Ill.
●Grant Wilson, Inc., 4115 W. Taylor St., Chicago, Ill.
Graton & Knight Mfg. Co., 356 Franklin St., Worcester, Mass.
Graver Tank & Mfg. Co., Inc., 4809 Todd Ave., East Chicago, Ind.
Great National Air Conditioning Corp., 1305-9 S. Lamar St., Dallas, Tex.
Greene, Tweed & Co., 101 Park Ave., New York, N. Y.
Greenfield Tap & Die Corp., Sanderson St., Greenfield, Mass.
Greenlee Mfg. Co., Rockford, Ill.
Grief, Edward C., 64 West End Ave., Bogota, N. J.
●Grinnell Co., Inc., 260 W. Exchange, Providence, R. I.
Griscom-Russell Co., The, 285 Madison Ave., New York, N. Y.
Grobet File Corp. of America, 3 Park Pl., New York, N. Y.
Grove Regulator Co., 1729 Poplar St., Oakland, Cal.
Guardian Electric Mfg. Co., 1621 W. Walnut St., Chicago, Ill.
Guardian Utilities Co., 215 E. Michigan St., Michigan City, Ind.
Guild & Garrison, Inc., 43 Keap St., Brooklyn, N. Y.
Guth Co., Edwin F., 2615 Washington Blvd., St. Louis, Mo.
Gylstrom Co., O., 108 W. Wells St., Milwaukee, Wis.

H

H-B Instrument Co., 2518 N. Broad St., Philadelphia, Pa.
H. & B. Sales Co., Ltd., 2875 Cherry Ave., Long Beach, Cal.
Haering Co., Inc., D. W., 2308 S. Winchester Ave., Chicago, Ill.
Hagan Corp., 600 Bowman Bldg., Pittsburgh, Pa.
Hague & Co., Inc., Alfred, 227 Thirty-fourth St., Brooklyn, N. Y.
Haines & Co., William S., 12th & Buttonwood Sts., Philadelphia, Pa.
●Hall Mfg. Co., Cedar Rapids, Ia.
Hamburg Boiler Wks., Inc., Grand St., Hamburg, Pa.
Hamilton Rubber Mfg. Co., Mead St., Trenton, N. J.
Hammett Mfg. Co., 209 W. 19th Ter., Kansas City, Mo.
Hammond Aircraft Corp., South San Francisco, Cal.
Hammond Brass Wks., Summer Blvd., Hammond, Mich.
Hampton Electric Tool Co., 700 Walnut St., Edgewood, Pittsburgh, Pa.
Hancock Valve Div., Manning, Maxwell & Moore Inc., 11 Elias St., Bridgeport, Conn.
Handley Brown Heater Co., Jackson, Mich.
Handy & Harman, 82 Fulton St., New York, N. Y.
Hardinge Mfg. & Oil Burner Co., 1770 Berteau St., Chicago, Ill.
Hardy, Inc., Charles, 415 Lexington Ave., New York, N. Y.
Hardy Mfg. Co., Inc., 126 Davis Ave., Dayton, O.
Harnischfeger Corp., 4400 W. National Ave., Milwaukee, Wis.
Harrington & King Perforating Co., 5655 Fillmore St., Chicago, Ill.
Harris, A. R., 4546 Hohman Ave., Hammond, Ind.
Harris Calorific Co., The, 5501 Cass Ave., N. W., Cleveland, O.
Harris & Co., Arthur, 210 N. Aberdeen St., Chicago, Ill.
Harrisburg Foundry & Machine Co., Inc., 7th & Curtin St., Harrisburg, Pa.
Harrisburg Steel Corp., 10th & Herr Sts., Harrisburg, Pa.
Harrison Radiator Div., Lockport, N. Y.
Harry Cooling Towers, Inc, 554 W. 48th St., New York, N. Y.
Hart & Cooley Mfg. Co., Holland, Mich.; Chicago office, 61 W. Kinzie St.
Hart & Crouse Corp., 301 Turner St., Utica, N. Y.
Hart Mfg. Co., Hamilton St., Hartford, Conn.
Hartmann Co., Chas., 985 Dean St., Brooklyn, N. Y.
Hartzell Propeller Fan Co., P. O. Box 909, Roosevelt Ave., Piqua, O.
Harvey-Whipple, Inc., Springfield, Mass.
Hasco Valve & Machine Co., 1819 W. St. Paul Ave., Milwaukee, Wis.
Haskell Mfg. Co., Wm. H., 20 Commerce St., Pawtucket, R. I.
Hastings Air Conditioning Co., Box 481, 615 W. South St., Hastings, Nebr.
●Hays Corp., E. 8th St., Michigan City, Ind.
Hays Mfg. Co., 801 W. 12th St., Erie, Pa.
Healy Ruff Co., 765 Hampden Ave., St. Paul, Minn.
Heartley Machine & Tool Co., 900-8 Summit Ave., Toledo, O.
Heating Assurance, Inc., 124 E. Augusta St., Spokane, Wash.
Hegeler Zinc Co., P. O. Box 599, Danville, Ill.
Hendley & Whittemore, 6 Blackhawk Blvd., Beloit, Wis.
Hendrick Mfg. Co., 37 Dundaff St., Carbondale, Pa.
Henry Furnace & Foundry Co., 3480 E. 49th St., Cleveland, O.
●Henry Valve Co., 1019 N. Spaulding Ave., Chicago, Ill.
Henry & Wright Mfg. Co., 760 Windsor St., Hartford, Conn.
Herbert Boiler Co., 2300 Bloomingdale Ave., Chicago, Ill.
Her-Born Engineering & Mfg. Co., 212 Columbus Ave., Sandusky, O.
Herbusch Corp., The, 706 Chestnut St., 210 Title Guaranty Bldg., St. Louis, Mo.
Hercules Chemical Co., Inc., 332 Canal St., New York, N. Y.
Hercules Float Wks., 200 Franklin St., Springfield, Mass.
Hershey Machine & Foundry Co., Motorstoker Div., Manheim, Pa.
Herske & Timmis, Inc., 33 W. 60th St., New York, N. Y.
●Hess Warming & Ventilating Co., 1211 S. Western Ave., Chicago, Ill.
Hetzel Roofing Products Co., 67 Main St., Newark, N. J.
Higgin Products, Inc., Newport, Ky.
Highside Chemicals Co., 195 Verona Ave., Newark, N. J.
Hill Diesel Engine Co., Lansing, Mich.
Hill, E. Vernon, 6826 W. Highland Ave., Chicago, Ill.
Hilo Varnish Corp., 42-60 Stewart Ave., Brooklyn, N. Y.
Hinde & Dauch Paper Co., Sandusky, O.
Hirschman Co., W. F., 1245 McKinley Parkway, Buffalo, N. Y.
Hobart Bros., Hobart Sq., Troy, O.
Hodge Boiler Wks., Summer St., East Boston, Mass.
Hodgman Mfg. Co., 135 Washington St., Taunton, Mass.
Hoffman Combustion Engineering Co., 710 Marquette Bldg., Detroit, Mich.
●Hoffman Specialty Co., Inc., Waterbury Natl. Bank Bldg., Waterbury, Conn.
Holcomb & Hoke Mfg. Co., 1545 Van Buren, Indianapolis, Ind.
Hollands Mfg. Co., Erie, Pa.
Hollup Corp., 3357 W. 47th Pl., Chicago, Ill.
Holsclaw Bros., Inc., Evansville, Ind.
Holtum Mfg. Co., Freeport, Ill.
Holtzer-Cabot Electric Co., 125 Amory St., Boston, Mass.
Homestead Valve Mfg. Co., P. O. Box 348, Coraopolis, Pa.
Hoppes Mfg. Co., 850 N. Belmont Ave., Springfield, O.
Horn Co., A. C., 43-36 Tenth St., Long Island City, N. Y.
Horton Mfg. Co., 3016 University Ave., S. E., Minneapolis, Minn.
Hossfeld Mfg. Co., 460 W. Third St., Winona, Minn.
Hotstream Heater Co., 8007 Grand Ave., Cleveland, O.
Hough Shade Corp., Janesville, Wis.
Houghton & Co., E. F., 240 W. Somerset St., Philadelphia, Pa.
Hound Packing Co., 4757 E. Ravenswood Ave., Chicago, Ill.
Howard Iron Wks. & Alberger Heater Co., 287 Chicago St., Buffalo, N. Y.
Howe Ice Machine Co., 2825 Montrose Ave., Chicago, Ill.
●Howell Electric Motors Co., Howell, Mich.
Howes Co., S. M., 511 Medford St., Charlestown District, Boston, Mass.
Hubbell Corp., 1315 W. Carroll Ave., Chicago, Ill.
Hudson Equipment Corp., 324 Third Ave., N., Minneapolis, Minn.
Hugo Mfg. Co., 49th Ave., W., & Superior St., West Duluth, Minn.
Hunt & Son, C. B., Salem, O.
Hunter Fan & Ventilating Co., Inc., 714 Sterick Bldg., Memphis, Tenn.
●Hussey & Co., C. G., 2850 Second Ave., Pittsburgh, Pa.
Huyette Co., Inc., Paul B., 401 N. Broad St., Philadelphia, Pa.
Hyatt Bearings Div., General Motors Sales Corp., Harrison, N. J.
Hynes Electric Heating Co., 240 Cherry St., Philadelphia, Pa.

I

Ice Cooling Appliance Corp., Morrison, Ill.
Ideal Commutator Dresser Co., 1096 Park Ave., Sycamore, Ill.
Ideal Electric & Mfg. Co., E. First & Oak Sts., Mansfield, O.
●Ilg Electric Ventilating Co., 2850 N. Crawford Ave., Chicago, Ill.
●Illinois Engineering Co., 2035 S. Racine Ave., Chicago, Ill.
Illinois Iron & Bolt Co., 918 S. Michigan Ave., Chicago, Ill.
Illinois Malleable Iron Co., 1801 Diversey Ave., Chicago, Ill.
Illinois Oil Co., 4th Ave. and 24th St., Rock Island, Ill.
●Illinois Testing Laboratories, 419 N. La Salle St., Chicago, Ill.
Illinois Zinc Co., 47th St. at Sacramento Ave., Chicago, Ill.
Imperial Brass Mfg. Co., 1200 W. Harrison St., Chicago, Ill.
Imperial Electric Co., 64 Ira Ave., Akron, O.
Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill.
●Independent Register Co., 3747 E. 93rd St., Cleveland, O.
Indian Trailer Corp., Koolroom Div., 2338 Indiana Ave., Chicago, Ill.
Industrial Engineering Corp., Evansville, Ind.
Industrial Lock Nut Co., South Hanover, Mass.
Industrial Mfg. & Engineering Co., 3845 N. Ravenswood Ave., Chicago, Ill.
Industrial Research, Lansdowne, Pa.
Industrial Service Laboratories, 915 W. Oklahoma Ave., Milwaukee, Wis.
Industrial Sheet Metal Wks., Inc., 628 E. Forest Ave., Detroit, Mich.
Ingersoll Steel & Disc Co., 310 S. Michigan Ave., Chicago, Ill.

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Ingersoll-Rand, 11 Broadway, New York, N. Y.
Inland Mfg. Co., 1120 N. Cicero Ave., Chicago, Ill.
Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
Inner-Tite Clamp Corp., 18 W. Jersey St., Elizabeth, N. J.
Insto-Gas Corp., 1900 E. Jefferson, Detroit, Mich.
Insulite Co., 1100 Builders Exchange Bldg., Minneapolis, Minn.
Insul-Wool Insulation Corp., Wichita, Kans.
Inter-Coastal Paint Corp., 15th St., and Southern R. R., East St. Louis, Ill.
International Boiler Works, East Stroudsburg, Pa.
International Correspondence Schools, Scranton, Pa.
●International Engineering, Inc., 1145 Bolander Ave., Dayton, O.
International Engineering Wks., Inc., Box 71, Framingham, Mass.
International Exposition Co., Grand Central Palace, New York, N. Y.
International Heater Co., 101 Park Ave., Utica, N. Y.
International Moistening Co., 489 S. Main St., Providence, R. I.
International Nickel Co., 67 Wall St., New York, N. Y.
International Nutyp Tool Co., 68 W. First St., Oswego, N. Y.
International Steel Co., 1545 Edgar St., Evansville, Ind.
International Vermiculite Co., 11th & Stanford Ave., Springfield, Ill.
Iona Ventilator Co., Inc., 2821-29 W. Dauphin St., Philadelphia, Pa.
Iowa Paint Mfg. Co., 118-20 Eighth St., Des Moines, Ia.
Iron Fireman Mfg. Co., 3170 W. 106 St., Cleveland, O.
Iwan Brothers, 1503 Prairie Ave., South Bend, Ind.

J

Jackson Co., Byron, P. O. Box 2017, Terminal Annex, Los Angeles, Cal.
Jackson & Church Co., 321 N. Hamilton Ave., Saginaw, Mich.
Jacobs Co., B. & J., 1729 John St., Cincinnati, O.
Jaden Mfg. Co., Inc., F., 1601 Second St., Hastings, Nebr.
Jamar Co., Walker, 367 S. First Ave., E. Duluth, Minn.
Jamieson Mfg. Co., 820 Eagle Ford Rd., Dallas, Tex.
Janette Mfg. Co., 556 W. Monroe St., Chicago, Ill.
Jarecki Mfg. Co., 1345 W. 12th St., Erie, Pa.
Jefferson Electric Co., 25th & Madison St., Bellwood, Ill.
Jefferson Union Co., Sales Office, 601 W. 26th St., New York, N. Y.; Factory, Lexington, Mass.
Jeffrey Mfg. Co., 859-99 N. Fourth St., Columbus, O.
●Jenkins Bros., 80 White St., New York, N. Y.
Jennison Co., 17 Putnam St., Fitchburg, Mass.
Jessop Steel Co., Washington, Pa.
●Jewel Mfg. Co., 1841 University Ave., St. Paul, Minn.
Joal Mfg. Corp., 2058 Canton St., Toledo, O.
Johns-Manville, 22 E. 40th St., New York, N. Y.
Johnson Bronze Co., 460 S. Mill St., New Castle, Pa.
Johnson Co., S. T., 940 Arlington St., Oakland, Cal.; 401 N. Broad St., Philadelphia, Pa.
Johnson Corp., 830 Wood St., Three Rivers, Mich.
Johnson Fan & Blower Corp., 1320 W. Lake St., Chicago, Ill.
Johnson Gas Appliance Co., 520 "E" Ave., N. W., Cedar Rapids, Ia.
Johnson Mfg. Co., 10th & Sycamore, Waterloo, Ia.
●Johnson Service Co., 507 E. Michigan St., Milwaukee, Wis.
Johnston Bros., Inc., Ferrysburg, Mich.
Johnston Co., William W., 115 Bayard St., Dayton, O.
Johnston & Jennings Co., 877 Addison Rd., Cleveland, O.
Johnston Tin Foil & Metal Co., 6100 S. Broadway, St. Louis, Mo.
Jones Foundry & Machine Co., W. A., 4401 Roosevelt Rd., Chicago, Ill.
Jones & Laughlin Steel Corp., Third & Ross St., Pittsburgh, Pa.
Jordan & Co., Paul R., 631 S. Delaware St., Indianapolis, Ind.
Justus Steam Trap Co., Napanoch, N. Y.

K

Kainer & Co., 761 W. Lexington, Chicago, Ill.
Kaiser Co., H. S., 3336 Franklin Blvd., Chicago, Ill.
Kane Mfg. Corp., Kane, Pa.
Kauffman Air Conditioning Corp., 4336 W. Pine Blvd., St. Louis, Mo.
●Kaufman, H. J., 13215 Roselawn Ave., Detroit, Mich.
Kaye & MacDonald, Inc., 92 Franklin Ave., West Orange, N. J.
Keasbey Co., Robert A., 139-149 W. 19th St., New York, N. Y.
Keasbey & Mattison Co., Butler Ave., Ambler, Pa.
Keckley Co., O. C., 400 W. Madison St., Chicago, Ill.
Keeler Co., E., 238 West St., Williamsport, Pa.
Keeney Mfg. Co., Main St., Newington, Conn.
Kehm Corp., The, 441 N. La Salle St., Chicago, Ill.
Keldur Corp., 420 Lexington Ave., New York, N. Y.
Kellogg Co., M. W., The, 225 Broadway, New York, N. Y.
Kelly-Koet, Covington, Ky.
Kelvinator Div., Nash-Kelvinator Corp., 14250 Plymouth Rd., Detroit, Mich.
Kelvin-White Co., 90 State St., Boston, Mass.
Kennard, Inc., Sam, 3331-3339 Market St., St. Louis, Mo.
Kennedy Valve Mfg. Co., The, Elmira, N. Y.
Kerentoff, G. L., 2803 Jefferson Ave., Cincinnati, O.
Kernchen Co., 103 E. Wacker Drive, Chicago, Ill.
Kerotest Mfg. Co., 2525 Liberty Ave., Pittsburgh, Pa.
Kester Solder Co., 4201 Wrightwood Ave., Chicago, Ill.
●Kewanee Boiler Corp., Kewanee, Ill.
Key Co., 2700 McCasland, East St. Louis, Ill.
Kidder Mfg. Co., Inc., J. F., 426 Colchester Ave., Burlington, Vt.
Kieley & Mueller, Inc., 34 W. 13th St., New York, N. Y.
Kimball-Krogh Pump Div., Food Machinery Corp., 301 West Ave. 26, Los Angeles, Cal.
Kimberly-Clark Corp., Neenah, Wis.
Kinetic Chemicals, Inc., 10th & Market St., Wilmington, Del.
King Engineering Corp., 1940 Willard Ave., Ann Arbor, Mich.
King Union Co., Inc., Hillsgrove, R. I.
King Ventilating Co., Box 178, Owatonna, Minn.
Kingsford Foundry & Machine Wks., 264 W. Second St., Oswego, N. Y.
Kinney Mfg. Co., 3529 Washington St., Boston, Mass.
Kirk & Blum Mfg. Co., 2838-52 Spring Grove Ave., Cincinnati, O.
Kisco Boiler & Engineering Co., 3732 Chouteau Ave., St. Louis, Mo.
Kisco Co., Inc., 39th and Chouteau Ave., St. Louis, Mo.
Klauer Mfg. Co., 9th and Washington Sts., Dubuque, Ia.
Klee Co., Geo. B., 1056-58 Hulbert Ave., Cincinnati, O.
Kleenaire Corp., 409 Jefferson St., Stevens Point, Wis.
Klingerit, Inc., 16-22 Hudson St., New York, N. Y.
Klipfel Mfg. Co., 2651 W. Harrison St., Chicago, Ill.
Knickerbocker Co., Jackson, Mich.
Knight, Maurice A., Kelly Ave., Akron, O.
Knowles Mushroom Ventilator Co., 11 Label St., Montclair, N. J.
Kohler Co., Kohler, Wis.
Kol-Master Corp., Oregon, Ill.
Kopperman & Sons, Joseph, 316 New St., Philadelphia, Pa.
Korfund Co., 48-15 32nd Pl., Long Island City, N. Y.
Koven & Bro., L. O., 154 Ogden Ave., Jersey City, N. J.
Kraissl Co., Inc., The, Terhune and Williams Aves., Hackensack N. J.
Kramer Trenton Co., 626 Brunswick Ave., Trenton, N. J.
Krehbiel Co., J. H., 425 N. Crawford Ave., Chicago, Ill.
●Krez Co., Paul J., 444 N. LaSalle St., Chicago, Ill.
Kuhlman Electric Co., Detroit Electric Furnace Div., Bay City, Mich.
Kuhns Bros. Co., 1800 McCall St., Dayton, O.
Kwikon Co, 626 W. Jackson Blvd., Chicago, Ill.

L

La Bour Pump Co., Inc., 1301 Sterling Ave., Elkhart, Ind.
Laclede Steel Co., Arcade Bldg., Rm. 1317, St. Louis, Mo.
Laclede Stoker Co., 4438 Hunt Ave., St. Louis, Mo.
La Crosse Steel Roofing & Corrugating Co., 300 S. Third St., La Crosse, Wis.
La Crosse Tractor Co., La Crosse, Wis.
Lammert & Mann Co., 281 N. Wood St., Chicago, Ill.
Lamneck Products, Inc., Middletown, O.
Lamson & Sessions Co., 1971 W. 85th St., Cleveland, O.
Landis Machine Co., Inc., 5th & Church Sts., Waynesboro, Pa.
Larkin Coils, Inc., 519 Fair St., S. E., Atlanta, Ga.
Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo.
Lastik Products Co., Inc., 603 American Bank Bldg., Pittsburgh, Pa.
●Lau Blower Co., 2001 Home Ave., Dayton, O.
Lawler Automatic Controls, Inc., 453 N. MacQuesten Pkwy., Mount Vernon, N. Y.
Lawrence Pump & Engine Co., P. O. Box 70, Lawrence, Mass.
Lawson Co., F. H., Evans & Whateley Sts., Cincinnati, O.
●Layne & Bowler, Inc., Memphis, Tenn.
Lead Lined Iron Pipe Co., 1 Broadway, Wakefield, Mass.
Leavitt Machine Co., East River St., Orange, Mass.
Lecourtenay Co., 5 Maine St., Newark, N. J.
Lee Engineering Co., Union National Bank Bldg., Youngstown, O.
Lee & Son Co., K. O., Aberdeen, S. D.
Lee & Son Co., Thomas, 128-132 W. Second St., Cincinnati, O.
Leeds & Northrup Co., 4970 Stenton Ave., Philadelphia, Pa.
Leffel & Co., James, 426 East St., Springfield, O.
Lehigh Fan & Blower Co., Front & Linden Sts., Allentown, Pa.
Lehon Co., 4411 Oakley Ave., Chicago, Ill.
Leinweber Fan & Blower Co., 8448 Crandon, Chicago, Ill.
Leland Electric Co., 1501 Webster St., Dayton, O.
Lennox Furnace Co., Marshalltown, Ia., Syracuse, N. Y., and Columbus, O.
Leonard Valve Co., Elmwood Station, Providence, R. I.
Leslie Co., Valley Brook & Grant Aves., Lyndhurst, N. J.
Leslie Welding Co., 2943 Carroll Ave., Chicago, Ill.
Lewellen Mfg. Co., Columbus, Ind.
Lewis & Co., Inc., Chas. S., 2207 Pine St., St. Louis, Mo.
Levow, David, 308 W. 20th St., New York, N. Y.
Leyman Mfg. Corp., John H. McGowan Co. Div., 954 Ellison Ave., Cincinnati, O.
Libbey-Owens-Ford Glass Co., Box 919, Toledo, O.
Lilie-Hoffman Cooling Towers, Inc., 4239 Duncan Ave., St Louis Mo.
Limbert & Co., Geo. B., 570 Fulton St., Chicago, Ill.
Lincoln Electric Co., 12818 Coit Rd., Cleveland, O.
Linde Air Products Co., The, Unit of Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Linear Packing & Rubber Co., Inc., N. W. Cor. State Rd. & Levick St., Philadelphia, Pa.

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Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill.; 519 N. Holmes Ave., Indianapolis, Ind.; 2045 W. Hunting Park Ave., Philadelphia, Pa.
Lion Mfg. Corp., 2701-11 Belmont Ave., Chicago, Ill.
Liquid Carbonic Corp., 3100 S. Kedzie Ave., Chicago, Ill.
Liquidometer Corp., 37-15 Skillman Ave., Long Island City, N. Y.
Lissberger & Son, Inc., Marks, 23-01 Borden Ave., Long Island City, N. Y.
Little Giant Vaporizer Co., 5101 Classen Blvd., Oklahoma City, Okla.
Little Mfg. Co., M. S., 151 New Park Ave., Hartford, Conn.
Littleford Bros., 421 E. Pearl St., Cincinnati, O.
Locke Regulator Co., 76 North St., Salem, Mass.
Lockformer Co., The, 4615 Arthington St., Chicago, Ill.
Lockjoint Wood Products Co., 1721 Mildred St., Wichita, Kans.
Locknut Corp. of America, 3403 W. 47th St., Chicago, Ill.
Lockport Fittings Co., Inc., Lockport, N. Y.
Logan Electric Specialty Mfg. Co., 412 S. Market St., Chicago, Ill.
Logan Engineering Co., Lawrence & Lamon Ave., Chicago, Ill.
Logansport Radiator Equipment Co., Logansport, Ind.
Lohman, Inc., Wm. J., 62 Ninth Ave., New York, N. Y.
Lonergan Co., J. E., 211 Race St., Philadelphia, Pa.
Long Mfg., Div. Borg-Warner Corp., 12501 Dequindre St., Detroit, Mich.
Lookout Boiler & Mfg. Co., Compress St. & Mfrs. Rd., Chattanooga, Tenn.
Lord Mfg. Co., 1633 W. 12th St., Erie, Pa.
Lovejoy Flexible Coupling Co., 5024 W. Lake St., Chicago, Ill.
Lowell Air Conditioning Corp., Otis Bldg., Philadelphia, Pa.
Lowell Wrench Co., 54 Commercial St., Worcester, Mass.
Loyal Knight Stokers, Inc., 800 Scheel St., Belleville, Ill.
Ludlow Valve Mfg. Co., Foot of Adams St., Troy, N. Y.
Lukens Steel Co., 308 S. First Ave., Coatesville, Pa.
Lumsden & Van Stone Co., 426 First St., South Boston, Mass.
Lunkenheimer Co., Waverly & Beekman Sts., Cincinnati, O.
Luzerne Rubber Co., Muirhead Ave., Trenton, N. J.
Lycoming Mfg. Co., Williamsport, Pa.
Lynchburg Foundry Co., Peoples Bank Bldg., Lynchburg, Va.
Lyon, Conklin & Co., Inc., McComas & Race Sts., Baltimore, Md.
Lytton Mfg. Corp., 102 First Ave., Franklin, Va.

M

Maas & Waldstein Co., 438 Riverside Ave., Newark, N. J.
Macksons Co., 125 Cedar St., New York, N. Y.
MacLean-Fogg Lock Nut Co., 2653 N. Kildare, Chicago, Ill.
Magirl Foundry & Furnace Wks., P. H., 413 E. Oakland Ave., Bloomington, Ill.
Magnet Switch Co., 361 W. Superior St., Chicago, Ill.
●Maid-O-Mist, Inc., 215 N. Aberdeen St., Chicago, Ill.
Maintenance Engineering Corp., 3611 Clinton Dr., Houston, Tex.
Majestic Co., 733 Erie St., Huntington, Ind.
Mall Tool Co., 7740 S. Chicago Ave., Chicago, Ill.
Malleable Iron Fittings Co., Branford, Conn.
Mallory Sales Co., 13904 Lincoln Ave., Dolton, Ill.
Manhattan Perforated Metal Co., Inc., 43-17 37th St., Long Island City, N. Y.
Manhattan Rubber Mfg., Div. of Raybestos-Manhattan, Inc., 61 Willett St., Passaic, N. J.
Manheim Mfg. & Belting Co., Manheim, Pa.
Manitowoc Boiler Wks., 16th & The River, Manitowoc, Wis.
Manker Products Co., Inc., 921 Rayner St., Memphis, Tenn.
Manley Products Corp., State & Hay Sts., York, Pa.
Manufacturers Fin Coil Co., 2505-7 S. Pulaski Rd., Chicago, Ill.
Manufacturers Machine Co., Railroad Ave., North Andover, Mass.
Maple Valley Mfg. Co., First St., Mapleton, Ia.
Maplewood Machinery Co., Inc., 2634 Fullerton Ave., Chicago, Ill.
Marathon Electric Mfg. Corp., 131 W. Washington St., P. O. 298, Wausau, Wis.
Marble-Card Electric Co., Gladstone, Mich.
Marblehead Lime Co., 160 N. LaSalle St., Chicago, Ill.
Marion Machine, Foundry & Supply Co., P. O. Box 685, 3rd and Big Four Ry., Marion, Ind.
●Marley Co., 3001 Fairfax Rd., Kansas City, Kans.
Marlin-Rockwell Corp., Jamestown, N. Y.
●Marlo Coil Co., 6135 Manchester Ave., St. Louis, Mo.
Marquette Mfg. Co., 401 Johnson St., Minneapolis, Minn.
Marsh Corp., Jas. P., 2073 Southport Ave., Chicago, Ill.
Marsh Tritrol Co., 600 S. Michigan Ave., Chicago, Ill.
Marsh Valve Co., 4th St. & Brigham Rd., Dunkirk, N. Y.
Marshalltown Mfg. Co., 901 E. Nevada, Marshalltown, Ia.
Martin, J. O. & C. U., 637 Minna St., San Francisco, Cal.
Martin Metal Mfg. Co., 900 E. Second St., Wichita, Kans.
Martin & Sons, H. P., 801 W. 12th St., Owensboro, Ky.
Martocello & Co., Jos. A., 229 N. 13th St., Philadelphia, Pa.
Masonite Corp., 111 W. Washington St., Chicago, Ill.
Masonite Corp., Cellufoam Products Div., 6565 S. Lavergne Ave., Chicago, Ill.
Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.
Master Electric Co., 100 Davis Ave., Dayton, O.
Matthiessen & Hegeler Zinc Co., 9th & Sterling Sts., La Salle, Ill.
Mauck Seamless Copper Tank Co., Victor, 309 E. Main, Norristown, Pa.
Maurath, Inc., 7309 Union Ave., Cleveland, O.
Maxim Silencer Co., 410 Asylum St., Hartford, Conn.
Mayflower Air-Conditioners, Inc., Newcomb & E. 7th St., St. Paul, Minn.
Mayson Mfg. Co., Inc., 4332 Horatio St., Detroit, Mich.
●McAlear Mfg. Co., 1901-1909 S. Western Ave., Chicago, Ill.
McAuley Trap Co., 405 Penn Ave., Pittsburgh, Pa.
McCann Furnace Co., 5005 Euclid Ave., Cleveland, O.
McCord Radiator & Mfg. Co., 2587 E. Grand Blvd., Detroit, Mich.
McCorkle Co., D. H., 6th & Bancroft Way, Berkeley, Cal.
●McDonnell & Miller, 400 N. Michigan Ave., Chicago, Ill.
McKay Co., McKay Bldg., 1005 Liberty Ave., Pittsburgh, Pa.
McLeod & Henry Co., Troy, N. Y.
McLouth Air Conditioning Corp., 2400 E. Michigan Ave., Lansing, Mich.
McPherson Furnace & Supply Co., 1805 N. E. Second Ave., Portland, Ore.
●McQuay, Inc., 1600 Broadway, N. E., Minneapolis, Minn.
McQuay-Norris Mfg. Co., Southwest Ave. at Marconi, St Louis, Mo.
McWane Cast Iron Pipe Co., 1201 Vanderbilt Rd., Birmingham, Ala.
Mears-Kane-Ofeldt, Inc., 1903-1915 E. Hagert St., Philadelphia, Pa.
Medart Co., 3500 DeKalb, St. Louis, Mo.
Meier Electric & Machine Co., 3525 E. Washington St., Indianapolis, Ind.
Mellish & Murray Co., 1715 Carroll Ave., Chicago, Ill.
Merchant & Evans Co., 2035 Washington Ave., Philadelphia, Pa.
Mercoid Corp., The, 4201 Belmont Ave., Chicago, Ill.
Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Mercury Clutch Corp., 637 W. Third St., Massillon, O.
Meriam Co., The, 1955 W. 112th St., Cleveland, O.
Merrell Mfg. Co., 644 Curtis St., Toledo, O.
Metal & Thermit Corp., 120 Broadway, New York, N. Y.
Metalace Corp., 60 K St., South Boston, Mass.
Metallo Gasket Co., 16 Bethany St., New Brunswick, N. J.
Metropolitan Refining Co., Inc., 23-28 50th Ave., Long Island City, N. Y.
Mettler Co., Lee B., 406 S. Main St., Los Angeles, Cal.
Meyer & Bro. Co., F., 1313 S. Adams St., Peoria, Ill.
Meyer Furnace Co., 1300 S. Washington St., Peoria, Ill.
Meyer Mfg. Co., 4823 Wabash Ave., Detroit, Mich.
Michell Air Conditioning Co., Inc., 1725 State St., Schenectady, N. Y.
Michigan Pipe Co., 503 Phoenix Bldg., Bay City, Mich.
Micro Products Co., 20 N. Wacker Dr., Chicago, Ill.
Micro Switch Corp., 1 E. Spring St., Freeport, Ill.
Micro-Westco, Inc., Bettendorf Office Bldg., Bettendorf, Ia.
Middleton Mfg. & Sales Co., 125 N. First St., Minneapolis, Minn.
●Midwest Piping & Supply Co., Inc., Second and Barry Sts., St Louis, Mo.
Milburn Co., Alexander, 1426 W. Baltimore St., Baltimore, Md.
Milcor Steel Co., S. 41st & Burnham Sts., Milwaukee, Wis.
Miller & Connell Co., 3720 W. North Ave., Chicago, Ill.
Miller Electric Mfg. Co., Inc., 905 N. Meade St., Appleton, Wis.
Miller Rubber Co., Inc., 1247 S. High St., Akron, O.
Millers Falls Co., 57 Wells St., Greenfield, Mass.
Mills Novelty Co., 4110 W. Fullerton Ave., Chicago, Ill.
Milwaukee Gas Specialty Co., 2025 W. Clybourn St., Milwaukee, Wis.
Milwaukee Reliance Boiler Wks., 2784 N. 32nd St., Milwaukee, Wis.
Milwaukee Valve Co., S. Burrell St. at E. Hayes Ave., Milwaukee, Wis.
Mineral Insulation Co., 103rd & Southwest Highway, Chicago Ridge, Ill.
●Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., South, Minneapolis, Minn.
Minn-Kota Foundry & Mfg. Co., 201 Second St., N., Fargo, N. D.
Misener Mfg. Co., Inc., 326 E. Washington St., Syracuse, N. Y.
Mitchell Moulding Co., 1501-15 Circle Ave., Forest Park, Ill.
Mitchell & Smith, Inc., 9469 Copeland Ave., Detroit, Mich.
Modern Engineering Co., 3411 Pine Blvd., St. Louis, Mo.
Modern Equipment Corp., Defiance, O.
●Modine Mfg. Co., 1772 Racine St., Racine, Wis.
Moeller Instrument Co., 132nd St. & 89th Ave., Richmond Hill, N. Y.
Mojonnier Bros. Co., 4601 W. Ohio St., Chicago, Ill.
Molock Foundry & Machine Co., Kaukauna, Wis.
Monarch Mfg. Works, Inc., Salmon & Westmoreland Sts., Philadelphia, Pa.
Monash-Younker Co., 1315 W. Congress St., Chicago, Ill.
Moncrief Furnace Co., P. O. Box 1673, Atlanta, Ga.
Monitor Controller Co., The, 51 S. Gay St., Baltimore, Md.
Monmouth Products Co., 1929-41 E. 61st St., Cleveland, O.
Montag Stove & Furnace Wks., 2011 N. Columbia Blvd., Portland, Ore.
Montgomery Bros., 61 Fremont St., San Francisco, Cal.
Moore Steam Turbine Div., Worthington Pump & Machinery Corp., Wellsville, N. Y.

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Moran Flexible Steam Joint Co., 217 W. Main St., Louisville, Ky.
Morehead Mfg. Co., 4895 Grand River Ave., Detroit, Mich.
Morey & Jones, Ltd., 922 S. Hemlock St., Los Angeles, Cal.
Morris Machine Wks., 50 E. Genesee St., Baldwinsville, N. Y.
Morrison Products, Inc., E. 168th St. and Waterloo Rd., Cleveland, O.
Morse Chain Co., Turner Pl., Ithaca, N. Y.
Mortell Co., J. W., 310 S. Michigan Ave., Chicago, Ill.
Motex Metal Process Corp., 4473-4475 W. Jefferson Ave., Detroit, Mich.
Mouat Vapor Heating Co., The, 1246-1254 W. 4th St., Cleveland, O.
Mountain States Equipment Co., 1238 Speer Blvd., Denver, Colo.
Mueller Brass Co., Port Huron, Mich.
Mueller Co., Decatur, Ill.
Mueller Furnace Co., L. J., 2005 W. Oklahoma Ave., Milwaukee, Wis.
●Mueller Steam Specialty Co., Inc., 40-20 22nd St., Long Island City, N. Y.
Muncie Gear Wks., Inc., Muncie, Ind.
●Mundet Cork Corp., 65 S. 11th St., Brooklyn, N. Y.
Mundt & Sons, Charles, Jersey City, N. J.
Munn and Steele, Inc., 130 Lister Ave., Newark, N. J.
Murray Iron Wks. Co., 1106 Washington St., Burlington, Ia.
●Murray Mfg. Co., D. J., Wausau, Wis.
Mutual Chemical Co. of America, 270 Madison Ave., New York, N. Y.
Myers & Bro. Co., F. E., The, Ashland, O.
Myers Electric Co., Inc., 410 Third Ave., Pittsburgh, Pa.

N

●Nash Engineering Co., South Norwalk, Conn.
Nash Refrigeration Co., Inc., 79 Poinier St., Newark, N. J.
Nason Co., 1050 Mt. Elliott Ave., Detroit, Mich.
National Airoil Burner Co., Inc., 1284 E. Sedgley Ave., Philadelphia, Pa.
National Aluminate Corp., 6621 W. 66th Pl., Chicago, Ill.
National Brass Co., 1603 Madison Ave., Grand Rapids, Mich.
National Brass & Copper Co., Inc., Lisbon, O.
National Carbon Co., Carbon Sales Div., P. O. Box 6087, Cleveland, O.
National Engineering Products, Inc., Commerce and Savings Bldg., Washington, D. C.
National Gypsum Co., Delaware Ave., Buffalo, N. Y.
National Lead Co., 111 Broadway, New York, N. Y.
National Machine Wks., Peoples Gas Bldg., Chicago, Ill.
National Mfg. Corp., 151 Fillmore Ave., Tonawanda, N. Y.
National Mfg. & Engineering Co., 416 Stephenson Bldg., Detroit, Mich.
National Metal Products Corp., 21 N. Loomis St., Chicago, Ill.
National Meter Co., 4221 First Ave., Brooklyn, N. Y.
National Pipe Bending Co., 122 River St., New Haven, Conn.
National Radiator Co., The, 221 Central Ave., Johnstown, Pa.
National Steam Pump Co., 701 W. Johnson St., Upper Sandusky, O.
National Steel Corp., Grant Bldg., Pittsburgh, Pa.
National Tube Co., United States Steel Corp. Subsidiary, Frick Bldg., Pittsburgh, Pa.
National Valve & Mfg. Co., 3101 Liberty Ave., Pittsburgh, Pa.
Naugatuck Mfg. Co., Union City, Conn.
Naylor Pipe Co., 1251 E. 92nd St., Chicago, Ill.
Nebel Mfg. Co., P. O. Box 3942, Shaker Sta., Cleveland, O.
Neemes Foundry, Inc., 216 First St., Troy, N. Y.
Nelson Chemical Pumps, Box 2235, Casper, Wyo.
Nelson Co., 2604 Fourth Ave., Detroit, Mich.
Nelson Corp., Herman, 2nd St., Moline, Ill.
Nelson Mfg. Co., B. F., Corner Main & Marshall Sts., N. E., Minneapolis, Minn.
Neptune Meter Co., 50 W. 50th St., New York, N. Y.
●Nesbitt, Inc., John J., & Buckeye Blower Co., State Rd. & Rhawn St., Philadelphia, Pa.
New Albany Machine Mfg. Co., E. 10th & Water Sts., New Albany, Ind.
New Departure Div., General Motors Sales Corp., Bristol, Conn.
New England Cooling Tower Co., 791 Tremont St., Boston, Mass.
New Haven Copper Co., Seymour, Conn.
New Jersey Zinc Sales Co., Front & Fletcher Sts., New York, N. Y.
New York Air Valve Corp., 611-621 Broadway, New York, N. Y.
New York Blower Co., 3155 Shields Ave., Chicago, Ill.
New York Brass Foundry, 405 Broome St., New York, N. Y.
Newark Wire Cloth Co., 351 Verona Ave., Newark, N. J.
Newman Brothers, Inc., 666 W. Fourth St., Cincinnati, O.
Newman Co., Inc., 6 E. 45th St., New York, N Y.
Newport Rolling Mill Co., Div. of The Andrews Steel Co., Ninth & Lowell Sts., Newport, Ky.
Niagara Blower Co., 6 E. 45th St., New York, N. Y.
Niagara Machine & Tool Wks., 637-697 Northland Ave., Buffalo, N. Y.
Nice Ball Bearing Co., 30th and Nicetown Lane, Philadelphia, Pa.
Nicholson & Co., W. H., 12 Oregon St., Wilkes-Barre, Pa.
Niles Rolling Mill Co., Niles, O.
Norge Div., Borg-Warner Corp., 670 E. Woodbridge St., Detroit, Mich.
Norgren Co., Inc., C. A., 222 Santa Fe Dr., Denver, Colo.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Norman Sheet Metal Mfg. Co., W. F., 212-236 N. Cedar St., Nevada, Mo.
Norristown Magnesia & Asbestos Co., Washington St., Norristown, Pa.
North American Fibre Products Co., The, Keith Bldg., Cleveland, O.
North American Mfg. Co., 2910 E. 75th, Cleveland, O.
Northern Blower Co., 6409 Barberton Ave., Cleveland, O.
Northern Equipment Co., 1945 Grove Drive, Erie, Pa.
Northern Indiana Brass Co., 935 Plum St., Elkhart, Ind.
Northwest Stove Works, 2345 S. E. Gladstone St., Portland, Ore.
Norwin Co., E. Album St., Freeport, Ill.
Norwood Filtration Co., The, N. Maple St., Florence, Mass.
Nu-Way Corp., 2416-4th Ave., Rock Island, Ill.
Nye Tool & Machine Wks., The, 4120-30 Fullerton Ave., Chicago, Ill.

O

Oakite Products, Inc., 22 Thames St., New York, N. Y.
Oberdorfer Brass Co., M. L., 2307 Thompson Rd., Syracuse, N. Y.
O'Brien Varnish Co., South Bend, Ind.
Ohio Brass Co., N. Main St., Mansfield, O.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, O.
Ohio Injector Co., Wadsworth, O.
Ohio Pattern Works & Foundry Co., Eureka Valve Div., 2735 Colerain Ave., Cincinnati, O.
Ohio Pipe Bending & Machine Co., 3900-3910 Trent Ave., Cleveland, O.
Ohio Products Co., 16507 Lucille Ave., Cleveland, O.
Ohio Welder Co., Middlefield, O.
Ohl & Son, George A., 159 Oraton St., Newark, N. J.
Ohmlac Paint & Refining Co., 6540 S. Central Ave., Chicago, Ill.
Oil City Tank & Boiler Co., Oil City, Pa.
Oil Well Supply Co., Oil City, Pa.
Ormsby-Osterman Co., 3631 Cass Ave., St. Louis, Mo.
Orr & Sembower, Inc., Box 817, Reading, Pa.
Osborn Co., The J. M. & L. A., 1541 E. 38th St., Cleveland, O.
Oster Mfg. Co., 2057 E. 61st Pl., Cleveland, O.
Ostlind Valve, Inc., Portland, Ore.
Otis Steel Co., 3341 Jennings Rd., Cleveland, O.
Owen Dyneto Div., U. S. L. Battery Corp., Syracuse, N. Y.
●Owens-Corning Fiberglas Corp., Nicholas Bldg., Toledo, O.
Ozalid Products Div., General Aniline & Film Corp., Ansco Rd., Johnson City, N. Y.
Ozone Air Co., 928 Cherry St., S. E., Grand Rapids, Mich.
Ozo-Ray Process Corp., 400 N. Sangamon St., Chicago, Ill.

P

PS Inc., 1227-35 Wall St., Los Angeles, Cal.
Pacific Gas Radiator Co., Huntington Park, Cal.
●Pacific Lumber Co., The, 100 Bush St., San Francisco, Cal.
Pacific States Felt & Mfg. Co., Inc., 845 Howard St., San Francisco, Cal.
Pacific Steel Boiler Div., United States Radiator Corp., 1056 First National Bank Bldg., Detroit, Mich.
Page Steel & Wire, Div. of American Chain & Cable Co., Inc., Monessen, Pa.
Paine Co., 2951 W. Carroll Ave., Chicago, Ill.
Pains Fireworks Display Co., 22 Park Pl., New York, N. Y.
Palmer Co., 2501 Norwood Ave., Cincinnati (Norwood), O.
Palmer Electric Co., 20 Sproat St., Detroit, Mich.
Palmer's Mfg. Corp., Phoenix, Ariz.
Palnut Co., 57 Cordier St., Irvington, N. J.
Pan-American Engineering Co., 820 Parker St., Berkeley, Cal.
Pangborn Corp., Pangborn Blvd., Hagerstown, Md.
Paragon Electric Co., 37 W. Van Buren St., Chicago, Ill.
Paragon-Revolute Corp., 65 South Ave., Rochester, N. Y.
Parker Appliance Co., 17325 Euclid Ave., Cleveland, O.
Parker-Kalon Corp., 200 Varick St., New York, N. Y.
Parkersburg Iron & Steel Co., Parkersburg, W. Va.
Parks-Cramer Co., 970 Main St., Fitchburg, Mass.
Patten Co., J. V., 500 De Kalb Ave., Sycamore, Ill.
Patterson Shade Co., 1142 N. Meridian St., Indianapolis, Ind.
Patterson-Ballagh Corp., 1900 E. 65th St., Los Angeles, Cal.
●Patterson-Kelley Co., Inc., East Stroudsburg, Pa.
Paxtix, Inc., 308 W. Washington St., Chicago, Ill.
Payne Furnace & Supply Co., Inc., 336-338 N. Foothill Rd., Beverly Hills, Cal,
Peabody Engineering Corp., 580 Fifth Ave., New York, N. Y.
Pease Co., C. F., The, 2601 W. Irving Park Rd., Chicago, Ill.
Peck & Co., W. J., 4327 W. Addison St., Chicago, Ill.
Peck, Stow & Wilcox Co., Center St., Southington, Conn.

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Pecora Paint Co., 4th & Penna. R. R., Philadelphia, Pa.
Pedrick Tool & Machine Co., 3640 N. Lawrence St., Philadelphia, Pa.
●Peerless of America, Inc., 515 W. 35th St., Chicago, Ill.
Peerless Electric Co., 3021 W. Market St., Warren, O.
Peerless Machine Co., 1615 Racine St., Racine, Wis.
Peerless Pump Div., Food Machinery Corp., 1250 Camden Ave., S. W., Canton, O.
Peerless Unit Ventilation Co., Inc., 810 Union Ave., Bridgeport, Conn.
Pels & Co., Inc., Henry, 90 West St., New York, N. Y.
Penberthy Injector Co., 1242 Holden Ave., Detroit, Mich.
Penn Electric Switch Co., Box 556, Goshen, Ind.
Penn Mfg. Corp. of Washington, Pa., 380 W. Chestnut St., P. O. Box 484, Washington, Pa.
Penn Ventilating Co., 2812 Richmond St., Philadelphia, Pa.
Pennsylvania Engineering Wks., 526 S. Jefferson St., New Castle, Pa.
Pennsylvania Flexible Metallic Tubing Co., 72nd St. and Powers Lane, Philadelphia, Pa.
Pennsylvania Forge Co., Milnor & Bleigh Sts., Philadelphia, Pa.
Pennsylvania Pump & Compressor Co., Easton, Pa.
Pennsylvania Salt Mfg. Co., 1341 Chestnut St., Philadelphia, Pa.
Perfect Circle Co., The, Hagerstown, Ind.
Perfection Grate & Stoker Co., 4 Fiske Ave., Springfield, Mass.
Perfection Refrigeration Parts Co., Harvey, Ill.
Perfex Corp. (Controls Div.), 500 W. Oklahoma Ave., Milwaukee, Wis.
Perfex Corp. (Unit Heater Div.), 500 W. Oklahoma Ave., Milwaukee, Wis.
Perham Products, Inc., 133 N. Wacker Dr., Chicago, Ill.
Perkins Machine Co., 4 Perkins Ave., Warren, Mass.
Perkins & Son, Inc., B. F., Chicopee St., Holyoke, Mass.
Permatex Co., Inc., Sheepshead Bay, N. Y.
Permutit Co., 330 W. 42nd St., New York, N. Y.
Pernot & Rich, Inc., 2546 San Fernando Rd., Los Angeles, Cal.
Peterson Freezem Mfg. & Sales Co., 316 Southwest Blvd., Kansas City, Mo.
Petroleum Heat & Power Co., 110 Davenport St., Stamford, Conn.
Petrometer Corp., 1 Star Sq., Long Island City, N. Y.
Pfening Co., Fred D., 1075 W. 5th Ave., Columbus, O.
Phelps Dodge Copper Products Corp., British American Tube Div., 40 Wall St., New York, N. Y.
Phelps Mfg. Co., 801 Thomas St., Little Rock, Ark.
Philadelphia Gear Co., Erie Ave. & G St., Philadelphia, Pa.
Philadelphia Pipe Bending Co., 4135-65 N. Fifth St., Philadelphia, Pa.
Philadelphia & Reading Coal & Iron Co., N. E. Cor. 12th & Market Sts., Philadelphia, Pa.
Philadelphia Thermometer Co., 915 Filbert St., Philadelphia, Pa.
Philco Radio & Television Corp., 3710 N. Broad St., Philadelphia, Pa.
Phillips & Co., H. A., 155 N. Union Ave., Chicago, Ill.
Phillips Cooling Tower Co., Inc., 15 John St., New York, N. Y.
Phoenix Brass Fittings Corp., Colt St. & Chancellor Ave., Irvington, N. J.
Phoenix Ice Machine Co., 2711 Church St., Cleveland, O.
Pier Equipment Mfg. Co., 1440 Milton St., Benton Harbor, Mich.
Pierce Butler Radiator Corp., 701 Nichols Ave., Syracuse, N. Y.
Pierce Co., Wm. B., The, 41 N. Division St., Buffalo, N. Y.
Pilley Brush Co., Fort Madison, Ia.
Pioneer Heat Regulator Div., Master Electric Co., The, 100 Davis Ave., Dayton, O.
Pioneer Roofing & Sheet Metal Co., 226 N. Main St., Muskogee, Okla.
Pipe Fabrication Institute, 1108 Clark Bldg., Pittsburgh, Pa.
Pittsburgh Brass Mfg. Co., 3155 Penn Ave., Pittsburgh, Pa.
Pittsburgh Equitable Meter Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Pittsburgh Lectrodryer Corp., P. O. Box 1766, Pittsburgh, Pa.
Pittsburgh Pipe Coil & Bending Co., 61 Bridge St., Etna, Pa.
Pittsburgh Piping & Equipment Co., 43rd St. & A. V. R. R., Pittsburgh, Pa.
Pittsburgh Steel Co., Grant Bldg., Pittsburgh, Pa.
Pittsburgh Tube Co., Vandergrift Bldg., Pittsburgh, Pa.
Pittsburgh Valve & Fittings Corp., Barberton, O.
Pittsburgh Water Heater Co., Box 1109, Pittsburgh, Pa.
Plandaire, Inc., 3223 Kennett Sq., Pittsburgh, 13, Pa.
Plant Rubber & Asbestos Works, 537 Brannan St., San Francisco, Cal.
Plastergon Wall Board Co., Philadelphia Ave., Buffalo, N. Y.
Plastic Products Co., 6475 Georgia Ave., Detroit, Mich.
Pleasantaire Corp., Tower Bldg., Washington, D. C.
Plummer Spray Equipment Co., 700 Filmore St., Napoleon, O.
Plymouth Cordage Co., Court St., N. Plymouth, Mass.; Anderson Products, Inc., Cambridge, Mass., National Sales Agents.
Pomona Pump Co., 206 E. Commercial St., Pomona, Cal.
Poole Foundry & Machine Co., 1700 Union Ave., Woodberry, Baltimore, Md.
●Porter & Co., Inc., H. W., 825 Frelinghuysen Ave., Newark, N. J.
Powell Co., Wm., 2525 Spring Grove Ave., Cincinnati, O.
Power King Tool Corp., P. O. Box 150, Warsaw, Ind.
Power Piping Div., Blaw Knox Co., 829 Beaver Ave., Pittsburgh, Pa.
Powers Regulator Co., 2720 Greenview Ave., Chicago, Ill.
Practical Instrument Co., 2717 N. Ashland Ave., Chicago, Ill.
Prat-Daniel Corp., Port Chester, N. Y.
Precision Control Co., 899 Bryant St., San Francisco, Cal.
Precision Thermometer & Instrument Co., 1434 Brandywine St., Philadelphia, Pa.
Preferred Utilities Mfg. Corp., 33 W. 60th St., New York, N. Y.
Premier Furnace Co., Box 150, Dowagiac, Mich.
Presstite Engineering Co., 3900 Chouteau St., St. Louis, Mo.
Propellair, Inc., 1345 Lagonda Ave., Springfield, O.
Prox Co., Inc., Frank, 1201 S. First St., Terre Haute, Ind.
Public Works Supply Co., 93 Brookline St., Lynn, Mass.
Puhl & Hepper Mfg. Co., 6400 W. Florissant Ave., St. Louis, Mo.
Purdue Associates, Albert G., 303 Wooster St., New Haven, Conn.
Pure Carbonic, Inc., 60 E. 42nd St., New York, N. Y.
Pyott Foundry & Machine Co., 328 N. Sangamon St., Chicago, Ill.
Pyrolite Products Co., Cleveland, O.
Pyrometer Instrument Co., 103 Lafayette St., New York, N. Y.

Q

Quaker City Iron Wks., Allegheny & Tulip Sts., Philadelphia, Pa.
Quaker Rubber Corp., Comly & Milnor, Philadelphia, Pa.
Quickwork-Whiting, Div. of Whiting Corp., Harvey, Ill.
Quimby Pump Co., Inc., 340 Thomas St., Newark, N. J.

R

R-S Products Corp., Germantown Ave., at Wayne Junction, Philadelphia, Pa.
R. U. V. Engineering Corp., 110 E. 42nd St., New York, N. Y.
Radiator Specialty Co., Charlotte, N. C.
Rafter Machine Co., 259 Stephens St., Belleville, N. J.
Raisler Sprinkler Co., 129 Amsterdam Ave., New York, N. Y.
Ramsay Chain Co., Inc., 1029 Broadway, Albany, N. Y.
Ramtite Co., The, 2563 W. 18th St., Chicago, Ill.
Ranco, Inc., 601 W. 5th Ave., Columbus, O.
●Randall Graphite Products Corp., 609 W. Lake St., Chicago, Ill.
Ransome Concrete Machinery Co., Dunellen, N. J.
Ravena Iron Co., Ravena, N. Y.
Rawlplug Co., Inc., The, 98 Lafayette St., New York, N. Y.
Ray Oil Burner Co., 401-499 Bernal Ave., San Francisco, Cal.
●Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Reading, Pa.
Red Jacket Mfg. Co., Davenport, Ia.
Red Spot Electric Co., 4302 S. Tacoma Way, Tacoma, Wash.
Reed Unit-Fans, Inc., 811 St. Charles St., New Orleans, La.
Reeves Pulley Co., 1000 N. Wilson St., Columbus, Ind.
Reeves Steel & Mfg. Co., Dover, O.
Refinite Corp., Refinite Bldg., Omaha, Neb.
Refractory & Insulation Corp., 381 Fourth Ave., New York, N. Y.
Refrigeration Appliances, Inc., 917-923 W. Lake St., Chicago, Ill.
Refrigeration Economics Co., Inc., 1232 Second St., N. E., Canton, O.
Rega Mfg. Co., 79 Mt. Hope Ave., Rochester, N. Y.
Register & Grille Mfg. Co., Inc., 70 Berry St., Brooklyn, N. Y.
Reichert Float & Mfg. Co., 2238 Smead Ave., Toledo, O.
Reif-Rexoil, Inc., 37-43 Carroll St., Buffalo, N. Y.
Reilly Tar & Chemical Corp., 1615 Merchants Bank Bldg., Indianapolis, Ind.
Reiner & Campbell, Inc., 242 Lafayette St., New York, N. Y.
Reliable Perforating Co., 2047 N. Wood St., Chicago, Ill.
Reliance Automatic Lighting Co., 1929 Mead St., Racine, Wis.
Reliance Electric & Engineering Co., Ivanhoe Rd., Cleveland, O.
Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland, O.
Reliance Refrigerating Machine Co., 3401 N. Kedzie Ave., Chicago, Ill.
Rempe Co., 340 N. Sacramento Blvd., Chicago, Ill.
Rensselaer Valve Co., Ontario St., Cohoes, N. Y.
Reps Tool, Inc., 220 Delaware Ave., Buffalo, N. Y.
Republic Flow Meters Co., 2240 Diversey Pkwy., Chicago, Ill.
Republic Rubber Div., Lee Rubber & Tire Corp., Youngstown, O.
●Republic Steel Corp., Republic Bldg., Cleveland, O.
Research Corp., Chrysler Bldg., New York, N. Y.
●Research Products Corp., 1011-1015 E. Washington Ave., Madison, Wis.
Resisto Pipe & Valve Co., 262 Bridge St., East Cambridge, Mass.
Resistoflex Corp., Belleville, N. J.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.
Reverse-Air Corp., 222 W. North Bank, Chicago, Ill.
Reynolds Electric Co., 2603 W. Congress, Chicago, Ill.
●Reynolds Mfg. Co., The, 412 Prospect St., N. E., Grand Rapids, Mich.
Reznor Mfg. Co., Mercer, Pa.
●Rhoads & Sons, J. H., 35 N. Sixth St., Philadelphia, Pa.
Rhode Island Fittings Co., Hillsgrove, R. I.
Rhode Island Humidifier & Ventilating Co., 99 Chauncey St., Boston, Mass.

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Rhodes, Inc., M. H., 30 Bartholomew St., Hartford, Conn.
Richmond Engineering Co., Inc., 7th and Hospital Sts., Richmond, Va.
Richmond Radiator Co., Gas Products Div., Uniontown, Pa.
●Ric-wiL Co., 1563 Union Trust Bldg., Cleveland, O.
Ridge Tool Co., Box 670, Elyria, O.
Riley Stoker Corp., 9 Neponset St., Worcester, Mass.
Robbins & Myers, Inc., Lagonda Ave., Springfield, O.
Roberts Tube Works, 2500 Military Ave., Detroit, Mich.
Roberts-Gordon Appliance Corp., 137 Arthur St., Buffalo, N. Y.
Roberts-Hamilton Co., 707-715 S. Third St., Minneapolis, Minn.
Robertson Co., H. H., 2000 Grant Bldg., Pittsburgh, Pa.
Rochester Mfg. Co., Rochester, N. Y.
Rock Island Register Co., 2435 Fifth Ave., Rock Island, Ill.
Rock River Machine Co., Inc., N. Main St., Janesville, Wis.
Rock Wool Products Co., P. O. Box 276, Wabash, Ind.
Rockford Brass Works, Rockford, Ill.
Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind.
Rockwood Sprinkler Co., 38 Harlow St., Worcester, Mass.
Roebling's Sons, John A., 640 S. Broad St., Trenton, N. J.
Roessing Mfg. Co., 1616 Noble St., Sharpsburg Sta., Pittsburgh, Pa.
Roller Bearing Co. of America, Whitehead Rd., Trenton, N. J.
Rolyan Corp., 2241 Indiana Ave., Chicago, Ill.
Rome-Turney Radiator Co., Canal St., Rome, N. Y.
Roots-Connersville Blower Corp., 16th St. & Columbia Ave., Connersville, Ind.
Roper Corp., Geo. D., Blackhawk Ave., Rockford, Ill.
Rosebraugh Co., W. W., 680 S. 17th St., Salem, Ore.
Rosedale Foundry & Machine Co., Columbus & Preble Aves., N. S., Pittsburgh, Pa.
Ross Engineering Corp., J. O., 350 Madison Ave., New York, N. Y.
Ross Heater & Mfg. Co., Inc., 1407 West Ave., Buffalo, N. Y.
Ross Sprinkler Co., 34 Roberts St., Pasadena, Cal.
Ross Valve Mfg. Co., Inc., 6 Oakwood Ave., Troy, N. Y.
Rotary Mfg. Co., 5718 Long Beach Ave., Los Angeles, Cal.
Rotary Seal Co., 809 W. Madison St., Chicago, Ill.
Roxalin Flexible Lacquer Co., Inc., 800 Magnolia Ave., Elizabeth, N. J.
Royal Air Conditioning Equipment Co., 1024 Westminster Ave., Alhambra, Cal.
Royal Ventilator Co., 415 Locust St., Philadelphia, Pa.
Royersford Foundry & Machine Co., Inc., Royersford, Pa.
Ruberoid Co., 500 Fifth Ave., New York, N. Y.
Ruby Chemical Co., 74 McDowell St., Columbus, O.
Ruemelin Mfg. Co., 3860 N. Palmer St., Milwaukee, Wis.
Ruggles-Klingemann Mfg. Co., 4 Foster Ct., Salem, Mass.
Rumsey Pump Corp., Seneca Falls, N. Y.
Rupp Forge & Shear Co., 10312 Meech Ave., Cleveland, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Russell Co., F. C., 6535 Euclid Ave., Cleveland, O.
Russell & Co., W. A., Bridgeport, Conn.
Russell Electric Co., 348 W. Huron St., Chicago, Ill.
Russell Mfg. Co., John M., Naugatuck, Conn.
Rutland Fire Clay Co., Curtis Ave., Rutland, Vt.
Ruud Mfg. Co., 2934 Smallman St., Pittsburgh, Pa.
Ryerson & Son, Inc., Jos. T., 2558 W. 16th St., Chicago, Ill.
Ryniker Sheet Metal Works, Inc., 122-124 N. 25th St., Billings, Mont.

S

●SKF Industries, Inc., Front St. & Erie Ave., Philadelphia, Pa.
St. Paul Corrugating Co., Wabash and Water Sts., St. Paul, Minn.
Sac Tool Mfg., 1907 Washington Ave., St. Louis, Mo.
Sales & Co., Murray W., 801 W. Baltimore Ave., Detroit, Mich.
Sall Mountain Co., 176 W. Adams St., Chicago. Ill.
Sampsel Time Control, Inc., Spring Valley, Ill.
Samson-United Corp., 1700 University Ave., Rochester, N. Y.
Sandberg Sheet Metal Works, 500 N. E. Union Ave., Portland, Ore.
Sangamo Electric Co., 1301 N. 11th St., Springfield, Ill.
●Sarco Co., Inc., 183 Madison Ave., New York, N. Y.
Sauereisen Cements Co., 2308 Main St., Sharpsburg, Pa.
Saunders Sons, Inc., D., 25 Atherton St., Yonkers, N. Y.
Scaife Co., 26 Ann St., Oakmont, Pa.
Schade Valve Mfg. Co., 2527 N. Bodine St., Philadelphia, Pa.
Schatz Mfg. Co., Fairview, Poughkeepsie, N. Y.
Schatz Venetian Blinds, Los Angeles, Cal.
Schaub Engineering Co., Fred H,. 325 W. Huron St., Chicago, Ill.
Schieren Co., Chas. A., 30-38 Ferry St., New York, N. Y.
Schneible Co., Claude B., 3951 Lawrence Ave., Chicago, Ill.
Schoedinger, F. O., 322-358 Mt. Vernon Ave., Columbus, O.
Schramm, Inc., West Chester, Pa.
Schubert-Christy Corp., Box 166, Affton Station, St. Louis, Mo.
Schundler & Co., Inc., F. E., 45-15 Vernon Blvd., Long Island City, N. Y.
Schutte & Koerting Co., 12th and Thompson Sts., Philadelphia, Pa.
Schwitzer-Cummins Co., Massachusetts Ave. at Fan St., Indianapolis, Ind.
Scientific Instrument Co., 531-35 W. Larned, Detroit, Mich.
Scott Valve Mfg. Co., 3963 McKinley Ave., Detroit, Mich.
Scott-Newcomb, Inc., 1922 Pine St., St. Louis, Mo.
Scovill Mfg. Co., Waterville Div., Waterville, Conn.
Sealed Power Corp., Muskegon, Mich.
Sealkote Corp., 40 S. Clinton St., Chicago, Ill.
Seamlex Co., Inc., 5-18 48th Ave., Long Island City, N. Y.
Season-Aire Corp. of America, 20 Bartlett St., Detroit, Mich.
Selas Co., The, 18th St. at Indiana Ave., Philadelphia, Pa.
Semet-Solvay Engineering Corp., 40 Rector St., New York, N. Y.
Semler Co., Jannette, Pa.
Seneca Rock Wool Co., 501 E. Market St., Tiffin, O.
Seneca Wire & Mfg. Co., Fostoria, O.
Servel, Inc., Electric Refrigeration & Air Conditioning Div., 119 Morton Ave., Evansville, Ind.
Service To Industry, Box 133, West Hartford, Conn.
Service Machine Co., 750-760 Broadway, Elizabeth, N. J.
Shafer Bearing Corp., 35 E. Wacker Dr., Chicago, Ill.
Shallcross Co., 48th and Grays Ferry Rd., Philadelphia, Pa.
Shallcross Controls, Inc., 121 N. Broadway, Milwaukee, Wis.
Shank Co., Cyrus, 625 W. Jackson Blvd., Chicago, Ill.
Sharon Steel Co., Sharon, Pa.
Shaw Co., Benjamin F., Second & Lombard Sts., Wilmington, Del.
Shaw-Kendall Engineering Co., 120-130 S. Superior St., Toledo, O.
●Shaw-Perkins Mfg. Co., Oliver Bldg., Pittsburgh, Pa.
Sheffler-Gross Co., Drexel Bldg., Philadelphia, Pa.
Shreveport Engineering Co., Inc., 1241 Dalzell St., Shreveport, La.
Sight Feed Generator Co., 14-18 N. 10th St., Richmond, Ind.
Signal Electric Mfg. Co., Menominee, Mich.
Simmons Co., Gordon H., 926 N. Cass St., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Pettyjohn Bldg., Lynchburg, Va.
Simplex Oil Heating Corp., 21 West St., New York, N. Y.
Sims Co., 18th & Whitley Sts., Erie, Pa.
Sinker-Davis Co., 230 S. Missouri St., Indianapolis, Ind.
Skidmore Corp., St. Joseph, Mich.
●Skilbeck Mfg. Co., 7432-27th Ave., Kenosha, Wis.
Skilsaw, Inc., 3310 N. Elston Ave., Chicago, Ill.
Skinner Co., M. B., South Bend, Ind.
Skinner Engine Co., 337 W. 12th St., Erie, Pa.
Skinner Heating & Ventilating Co., Inc., Div. of St. Louis Blow Pipe & Heater Co., 1954 N. 9th St., St. Louis, Mo.
Skinner Irrigation Co., 1212 E. Canal St., Troy, O.
Slater Mfg. Co., 24 Water St., Wakefield, Mass.
Sly Mfg. Co., W. W., 4700 Train Ave., Cleveland, O.
Smith Co., Inc., H. B., The, 57 Main, Westfield, Mass.
Smith Heater Co., Peter, 6209 Hamilton St., Detroit, Mich.
Smith, Inc., James Campbell, 1679 Collamer Rd., Cleveland, O.
Smith, Inc., Winfield H., Eaton St., Springville, N. Y.
Smith & Kanzler, Inc., 516-534 Lidgerwood Ave., Elizabeth, N. J.
Smith Meter Co., 5743 E. Leneve St., Los Angeles, Cal.
Smith Twin Tubular Boiler Co., Inc., Cottman St., at State Rd., Philadelphia, Pa.
Smith Welding Equipment Co., 2633 S. E. Fourth St., Minneapolis, Minn.
Smolensky Valve Co., Inc., 1931 W. 47th St., Cleveland, O.
Smooth-On Mfg. Co., 568-574 Communipaw Ave., Jersey City, N. J.
Snap-On Tools Corp., Kenosha, Wis.
Snead, Herbert S., 205 E. 42nd St., New York, N. Y.
Snoair, 1904 N. Field St., Dallas, Tex.
Solvay Sales Corp., 42 Rector St., New York, N. Y.
Somers, Inc., H. J., 6063 Wabash Ave., Detroit, Mich.
Somerville Iron Wks., Somerville, N. J.
Sonner Burner Co., Winfield, Kans.
South Bend Air Products Corp., 304 E. Colfax Ave., South Bend, Ind.
South Chester Tube Co., Front & Thurlow Sts., Chester, Pa.
Southbridge Roofing Co., Inc., Hartwell and Chapin Sts., Southbridge, Mass.
Southern States Iron Roofing Co., Stiles Ave., Savannah, Ga.
Southworth Machine Co., 30 Warren Ave., Portland, Me.
●Spang Chalfant, Inc., Div. of National Supply Co., Grant Bldg., Pittsburgh, Pa.
Specialty Converters, Inc., East Braintree, Mass.
Speedmaster Co., The, 1203 Thacker St., Des Plaines, Ill.
Speedway Mfg. Co., 1834 S. 52nd Ave., Chicago (Cicero), Ill.
●Spence Engineering Co., Inc., 32 Grant St., Walden, N. Y.
Spencer Heater Div., Aviation Mfg. Corp., 164 Park St., Williamsport, Pa.
Spencer Thermostat Co., 34 Forest St., Attleboro, Mass.
Spencer Turbine Co., 486 New Park Ave., Hartford, Conn.
●Spoehrer-Lange Co., 3723 Commonwealth St., St. Louis, Mo.
Spray Engineering Co., 114 Central St., Somerville, Mass.
●Spraying Systems Co., 4031 W. Lake St., Chicago, Ill.
Sprayo-Flake Co., 2715 Irving Park Blvd., Chicago, Ill.
Spray-Wheel Air Conditioners, Inc., 1320 Nineteenth St., Denver, Colo.
Sprout-Waldron & Co., Muncy, Pa.
Square D Co., 6060 Rivard St., Detroit, Mich.
Square D Co., 4041 N. Richards St., Milwaukee, Wis.
Squires Co., C. E., E. 40th St. & Kelley Ave., Cleveland, O.
Standard Asbestos Mfg. Co., 820-822 W. Lake St., Chicago, Ill.
Standard Engineering Wks., 289 Roosevelt Ave., Pawtucket, R. I.
Standard Fuel Engineering Co., 667 Post Ave., S., Detroit, Mich.
Standard Galvanizing Co., 2619 W. Van Buren St., Chicago, Ill.
Standard Lime & Stone Co., 2004 First National Bank Bldg., Baltimore, Md.

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Standard Pressed Steel Co., Jenkintown, Pa.
Standard Products Co., Fisher Bldg., Detroit, Mich.
Standard Reseater Corp., 423 W. 126th St., Orange, Mass.
Standard Rolling Mills, Inc., 143 Jewel St., Brooklyn, N. Y.
Standard Stamping & Perforating Co., 3131 W. 49th Pl., Chicago, Ill.
Standard Stoker Corp., The, New Albany, Ind.
Standard Thermometer, Inc., 65 Shirley St., Boston, Mass.
Standard Tube Co., 14600 Woodward Ave., Highland Park, Mich.
Standard Union Co., 71 Gooding St., Lockport, N. Y.
Stanley Electric Tool Div., Elm St., New Britain, Conn.
Staples & Pfeiffer, Ltd., 528 Bryant St., San Francisco, Cal.
Star Electric Motor Co., 197 Grove St., Bloomfield, N. J.
Star Expansion Bolt Co., 147 Cedar St., New York, N. Y.
Star Mfg. Co., Inc., 530 Kinsley Ave., Providence, R. I.
Star Products Co., 130 Walnut Ave., New York, N. Y.
Starr Piano Co., Richmond, Ind.
●Staynew Filter Corp., 25 Leighton Ave., Rochester, N. Y.
Steamaire Co., Cincinnati, O.
Steel Improvement & Forge Co., 960 Addison Rd., Cleveland, O.
Steel Products Engineering Co., Columbia St. & Dakota Ave., Springfield, O.
Steel and Tubes, Div. of Republic Steel Corp., 224 E. 131st St., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles, Cal.
Sterling Engineering & Mfg. Corp., 117 Business St., Hyde Park, Mass.
Sterling, Inc., 3738 N. Holton St., Milwaukee, Wis.
Sterling Pump Corp., Hamilton, O.
Stewart Ice Machine Co., 1046 E. 22nd St., Los Angeles, Cal.
Stickle Steam Specialties Co., 2215 Valley Ave., Indianapolis, Ind.
Stockham Pipe Fittings Co., 4100 Tenth Ave., N., Birmingham, Ala.
Stok-A-Fire Co., 6504 Olive St., University City, Mo.
Stokermatic Co., 1415 S. State St., Salt Lake City, Utah.
Stokes Rubber Co., Jos., Taylor & Webster, Trenton, N. J.
Straight Line Foundry & Machine Corp., Direct Separator Div., The, 218 S. Geddes St., Syracuse, N. Y.
Strandwitz & Co., Inc., W. J., Jefferson and Master Sts., Camden, N. J.
Streamline Pipe & Fittings Div., Mueller Brass Co., Port Huron, Mich.
Strong, Carlisle & Hammond Co., The, 1392 W. Third St., Cleveland, O.
Struthers Dunn, Inc., 1332 Cherry St., Philadelphia, Pa.
Struthers-Wells-Titusville Co., Titusville, Pa.
Stuart, W. W., 417 Ninth St., Des Moines, Iowa.
Sturtevant Co., B. F., Damon St., Hyde Park, Boston, Mass.
Sturtevant Mill Co., Park and Clayton Sts., Dorchester, Boston, Mass.
Sullivan Valve & Engineering Co., 910 S. Arizona St., Butte, Mont.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Super Radiator Corp., 320 Plymouth Bldg., Minneapolis, Minn.
Superior Railway Products Corp., 7501 Thomas Blvd., Pittsburgh, Pa.
Superior Sheet Steel Co., The, Division of Continental Steel Corp., Canton-Louisville Rd., Canton, O.
Superior Steel Corp., Grant Bldg., Pittsburgh, Pa.
Superior Valve and Fittings Co., 1509 W. Liberty Ave., Pittsburgh, Pa.
Superseal Corp., 300 Fourth Ave., New York, N. Y.
Superstat Co., 33 Walter St., Springfield, Mass.
Supreme Air Filter Co., 126 W. 21st St., New York, N. Y.
Supreme Electric Products Corp., 99 Mt. Hope Ave., Rochester, N. Y.
Supreme Heater & Ventilating Corp., 1911 N. Market St., St. Louis, Mo.
●Surface Combustion Corp., 2375 Dorr St., Toledo, O.
Swaby Mfg. Co., 2330 W. Cermak Rd., Chicago, Ill.
Swaine Mfg. Co., Fred J., 1300 N. Seventh St., St. Louis, Mo.
Swartwout Co., 18511 Euclid Ave., Cleveland, O.
Swedish Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Swift Mfg. Co., 247 McDougall Ave., Detroit, Mich.
Swoboda, Inc., H. O., 13th St., New Brighton, Pa.

T

Taber Pump Co., 272 Elm St., Buffalo, N. Y.
Taco Heaters, Inc., 342 Madison Ave., New York, N. Y.
Tagliabue Mfg. Co., C. J., 540 Park Ave., Brooklyn, N. Y.
Tallmadge & Co., Webster, 255 N. 18th St., East Orange, N. J.
Taylor Engineering Co., Metropole Hotel, Cincinnati, O.
●Taylor Forge & Pipe Wks., P. O. Box 485, Chicago, Ill.
●Taylor Instrument Companies, 95 Ames St., Rochester, N. Y.
Taylor-Hall Welding Corp., 99 Hope Ave., Worcester, Mass.
Taylor-Winfield Corp., 1052 Mahoning Ave., Warren, O.
Tecumseh Products Co., Tecumseh, Mich.
Telsit Insulation Co., 1933 West Farms Rd., Bronx, N. Y.
Templeton Bros., 189 Belgrade Ave., Roslindale Station, Boston, Mass.
●Tennessee Coal, Iron & Railroad Co., Brown-Marx Bldg., Birmingham, Ala.
Tennessee Products Corp., American National Bank Bldg., Nashville, Tenn.
Tenney Engineering, Inc., 46 Farrand St., Bloomfield, N. J.
Terry Steam Turbine Co., The, P. O. Box 1200, Hartford, Conn.
Textite Corp., 2110 Roscoe St., Chicago, Ill.
Thatcher Furnace Co., 39 St. Francis St., Newark, N. J.
Thermal Co., Inc., 1434 N. Fourth St., Milwaukee, Wis.
Thermal Engineering Associates, 1618 North Shore Ave., Chicago, Ill.
Therminsul Corp., 1603 Fulford St., Kalamazoo, Mich.
Thermoid Rubber Co., Whitehead Rd., Trenton, N. J.
Thermo-Mix, Inc., 4009 21st St., Long Island City, N. Y.
Thompson & Co., Box 6757, Pittsburgh, Pa.
Thomson-Gibb Electric Welding Co., 161 Pleasant St., Lynn, Mass.
Thrush & Co., H. A., Peru, Ind.
Thwing-Albert Instrument Co., 3339 Lancaster Ave., Philadelphia, Pa.
Tierney Rotor Ventilator Co., 239 Fourth Ave., S., Minneapolis, Minn.
Tiffin Art Metal Co., Broad and Second Ave., Tiffin, O.
●Tilco-Fin, Inc., 58 Second Ave., Brooklyn, N. Y.
Timken Roller Bearing Co., 1835 Dueber Ave., S. W., Canton, Ohio.
Timken Silent Automatic Div., Timken-Detroit Axle Co., 100 Clark Ave., Detroit, Mich.
Timken Steel & Tube Co., Canton, O.
Tippett & Wood, Morris and Warren Sts., Phillipsburg, N. J.
Titeflex Metal Hose Co., 500 Frelinghuysen Ave., Newark, N. J.
Titusville Iron Wks. Co., S. Franklin St., Titusville, Pa.
Todd Air Conditioning Co., Inc., Bonner Springs, Kans.
Todd Combustion Equipment, Inc., 601 W. 26th St., New York, N. Y.
Toledo Pipe Threading Machine Co., 1445 Summit St., Toledo, Ohio.
Torchweld Equipment Co., Div. of National Cylinder Gas Co., 1035 W. Lake St., Chicago, Ill.
Tork Clock Co., Inc., 1 Grove St., Mt. Vernon, N. Y.
Torrey Refrigeration Products, 1000 N. Orange Dr., Los Angeles, Cal.
●Torrington Mfg. Co., 70 Franklin St., Torrington, Conn.
Trade-Wind Motor Fans, Inc., 1325 Maple Ave., Los Angeles, Cal.
Trageser Steam Copper Wks., John, 5000 Grand St., Maspeth, Long Island, N. Y.
●Trane Co., La Crosse, Wis.
Trent Co., Harold E., 55th and Wyalusing, Philadelphia, Pa.
Trerice Co., H. O., 1420 W. Lafayette Blvd., Detroit, Mich.
Triangle Mfg. Co., 396 Division St., Oshkosh, Wis.
Trimont Mfg. Co., 55-71 Amory St., Roxbury, Boston, Mass.
Trimount Rotary Power Co., 398 Whiting Ave., East Dedham, Mass.
Trindl Products, Ltd., 2227 Calumet Ave., Chicago, Ill.
Triplex Mfg. Co., Peru, Ind.
Triumph Ice Machine Co., 107-109 E. Front St., Cincinnati, O.
Troy Engine & Machine Co., Troy, Pa.
Truflo Fan Co., 523 Main St., Harmony, Pa.
Trumbull Electric Mfg. Co., Woodford Ave., Plainville, Conn.
Truscon Steel Co., 1315 Albert St., Youngstown, O.
Tryco Products, Inc., Railroad Sq., Westfield, Mass.
●Tube-Turns, 238 E. Broadway, Louisville, Ky.
Turner Brass Wks., 823-47 Park Ave., Sycamore, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago, Ill.
Tuttle Air Filter Co., Inc., 1014 W. Main St., Louisville, Ky.
●Tuttle & Bailey, Inc., Corbin Ave., New Britain, Conn.
XXth Century Heating and Ventilating Co., Cor. Ira & Edison Aves., Akron, O.

U

●U. S. Air Conditioning Corp., 2101 Kennedy St., N. E., Minneapolis, Minn.
U. S. Electrical Motors, Inc., 200 E. Slauson Ave., Los Angeles, Cal.
U. S. Electrical Tool Co., 2488-2496 W. 6th St., Cincinnati, O.
U. S. Expansion Bolt Co., P. O. Box 827, State St. & P. R. R., York, Pa.
U. S. Hame Co., 135 Tonawanda St., Buffalo, N. Y.
U. S. Motors Corp., Oshkosh, Wis.
U. S. Stoneware Co., 60 E. 42nd St., New York, N. Y.
Uehling Instrument Co., 473 Getty Ave., Paterson, N. J.
Una Welding, Inc., 1615 Collamer Ave., E., Cleveland, O.
Underground Steam Construction Co., 73 Pitts St., Boston, Mass.
Unified Air Conditioner Co., Torry Bldg., Duluth, Minn.
Uniflow Mfg. Co., E. Lake Rd., Erie, Pa.
Union Asbestos & Rubber Co., 54th Ave. and 18th St., Cicero, Ill.
Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Union Iron Wks., 1500 Cascade St., Erie, Pa.
Union Metal Wks., Inc., 80 Carter St., Chelsea, Mass.
Union Steam Pump Co., Capitol Ave., S. W., Battle Creek, Mich.

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Union Water Meter Co., 333 Hermon St., Worcester, Mass.
United Cork Companies, Central Ave., Kearney, N. J.
United Electric Controls Co., 69 A St., Boston, Mass.
United Metal Hose Co., Inc., 36-01 43rd Ave., Long Island City, N. Y.
United Motors Service Co., General Motors Bldg., Detroit, Mich.
United States Brass & Copper Co., Hyde Park, Boston, Mass.
United States Gauge Co., 44 Beaver St., New York, N. Y.
United States Gypsum Co., 300 W. Adams St., Chicago, Ill.
United States Mineral Wool Co., 9 S. Clinton St., Chicago, Ill.
United States Ozone Co. of America, Crescent St., Scottdale, Pa.
United States Pipe & Foundry Co., Burlington, N. J.
United States Radiator Corp., 1056 National Bank Bldg., Detroit, Mich.
United States Register Co., Burnham St., Battle Creek, Mich.
United States Rubber Co., 1790 Broadway, New York, N. Y.
● United States Steel Corp., 436 Seventh Ave., Pittsburgh, Pa.
United Superior Union Co., Inc., 29 Ryerson St., Brooklyn, N. Y.
Universal Air Filter Corp., Duluth, Minn.
Universal Cooler Corp., Marion, O.
Universal-Cyclops Steel Corp., Bridgeville, Pa.
Universal Gypsum & Lime Co., 111 W. Washington St., Chicago, Ill.
Universal Motor Co., 323 Universal Ave., Oshkosh, Wis.
Universal Power Corp., 4300 Euclid Ave., Cleveland, O.
Universal Zonolite Insulation Co., 135 S. LaSalle St., Chicago, Ill.
Uno Ventilator Co., 565 Lincoln Ave., Cliftondale, Mass.
Upson Co., Upson Point, Lockport, N. Y.
Utica Radiator Corp., 2201 Dwyer Ave., Utica, N. Y.
Utility Fan Corp., 2528 Santa Fe Ave., Los Angeles, Cal.

V

Vanderman Mfg. Co., Mansfield Ave., Willimantic, Conn.
Van Dorn Electric Tool Co., Towson, Md.
Van Noorden Co., E., 100 Magazine St., Boston, Mass.
Vapor Car Heating Co., Inc., 80 E. Jackson Blvd., Chicago, Ill.
Vapor Specialty Co., 101 W. 42nd St., New York, N. Y.
Ventilating Products Co., 2800 Cottage Grove Ave., Chicago, Ill.
Verson Allsteel Press Co., 93rd & Kenwood Ave., Chicago, Ill.
VibraSeal Corp., 2832 E. Grand Blvd., Detroit, Mich.
● Vibration Eliminator Co., 8-22 Astoria Blvd., Astoria, N. Y.
Victaulic Co. of America, 30 Rockefeller Plaza, New York, N. Y.
Victor Electric Products, Inc., 2950 Robertson Rd., Cincinnati, O.
Vigor-Aire Corp., 127 S. 5th St., Philadelphia, Pa.
Viking Air Conditioning Corp., 9500 Richmond Ave., Cleveland, O.
Viking Pump Co., Fourth and State Sts., Cedar Falls, Ia.
Viking Shear Co., 1063 W. 19th St., Erie, Pa.
● Vilter Mfg. Co., 2148 S. First St., Milwaukee, Wis.
Vinco Co., Inc., The, 305 E. 45th St., New York, N. Y.
Virginia Smelting Co., West Norfolk, Va.
Viscostat Co., 30 N. La Salle St., Chicago, Ill.
Vitreous Enameling & Stamping Co., 1381 Sedgwick Ave., New York, N. Y.
Vogt Machine Co., Henry, 10th & Ormsby Sts., Louisville, Ky.
Vortex Mfg. Co., 687 N. Tillamook St., Portland, Ore.
Voss Co., J. H. H., 408 Concord Ave., New York, N. Y.
Vulcan Electric Co., Lynn, Mass.
Vulcan Radiator Co., 26 Francis Ave., Hartford, Conn.

W

● Wagner Electric Corp., 6400 Plymouth Ave., St. Louis, Mo.
Wailes Dove-Hermiston Corp., Westfield, N. J.
Waldron Corp., John, New Brunswick, N. J.
Walker and Eder, Inc., 37 W. 39th St., New York, N. Y.
Walker Jamar Co., 367 S. First Ave., E., Duluth, Minn.
Wallace Supplies Mfg. Co., 1310 Diversey Pkwy., Chicago, Ill.
Walsh-Holyoke Steam Boiler Co., Holyoke, Mass.
Walworth Co., 60 E. 42nd St., New York, N. Y.
Ward Foundries, Inc., J. P., Blossburgh, Pa.
● Ward Leonard Electric Co., 37 South St., Mt. Vernon, N. Y.
Ward Machinery Co., 564 W. Washington Blvd., Chicago, Ill.
Warlo Corp., 330 W. 42nd St., New York, N. Y.
Warren Electric Appliance Co., Warren Bank & Trust Co. Bldg., Warren, Pa.
Warren Foundry & Pipe Corp., 11 Broadway, New York, N. Y.
Warren Shade Co., Inc., 2905 E. Hennepin Ave., Minneapolis, Minn.
Warren Steam Pump Co., Inc., Warren, Mass.
● Warren Webster & Co., 17th and Federal Sts., Camden, N. J.
Washburne & Co., E. G., 207 Fulton St., New York, N. Y.
Water Cooling Tower Co., 605 W. Washington Blvd., Chicago, Ill.
Water Refining Co., 1123 Barthold, Ft. Wayne, Ind.
Waterfilm Boilers, Inc., 154 Ogden Ave., Jersey City, N. J.
● Waterloo Register Co., 2520 E. 4th St., Waterloo, Ia.
Watson & McDaniel Co., 440 N. Marshall, Philadelphia, Pa.
● Watson-Stillman Co., 140 Aldene Rd., Roselle, N. J.
Watts Regulator Co., 10 Embankment St., Lawrence, Mass.
Waukesha Motor Co., Waukesha, Wis.
Waverly Heating Supply Co., 31 Union St., Boston, Mass.
Way Loctor Access Panel Co., 420 Boylston St., Boston, Mass.
Wayne Oil Burner Corp., 800 Glasgow Ave., Fort Wayne, Ind.
Weatherhead Co., 300 E. 131st St., Cleveland, O.
Weaver Mfg. Co., Springfield, Ill.
● Webster & Co., Warren, 17th & Federal Sts., Camden, N. J.
● Webster Engineering Co., 419 W. Second St., Tulsa, Okla.
Webster Tallmadge & Co., 255 N. 18th St., East Orange, N. J.
Wedge Protectors, Inc., 9522 Richmond Ave., Cleveland, O.
Weil Pump Co., 215-17 W. Superior St., Chicago, Ill.
Weil-McLain Co., 641 W. Lake St., Chicago, Ill.
Weinman Pump Co., 290 Spruce St., Columbus, O.
Weirton Steel Co., Weirton, W. Va.
Weksler Thermometer Corp., 535 Pearl St., New York, N. Y.
Weldex, Inc., 7326 McDonald Ave., Detroit, Mich.
Welding Apparatus Co., 341 N. Pulaski Rd., Chicago, Ill.
Western Blower Co., 1800 Airport Way, Seattle, Wash.
Western Engineering & Mfg. Co., 1726 E. Washington Blvd., Los Angeles, Cal.
● Western Felt Wks., 4029-4117 Ogden Ave., Chicago, Ill.
Western Furnaces, Inc., 950 Commerce St., Tacoma, Wash
Western Hanger Co., 55 New Montgomery St., San Francisco, Cal.
Western Precipitation Corp., 1016 W. 9th St., Los Angeles, Cal.
Western Silicair Products, Inc., 72 S. Alameda Ave., Burbank, Cal.
Western Venetian Blind Co., 601 W. 26th St., New York, N. Y.
Western Wire & Iron Works, Inc., 945 W. 18th Pl., Chicago, Ill.
Western Wire Products Co., 1415-35 S. 18th St., St. Louis, Mo.
Westfalia Separator Co., 30 Orange St., Bloomfield, N. J.
Westinghouse Electric & Mfg. Co., Bloomfield, N. J.
● Westinghouse Electric & Mfg. Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Springfield, Mass.
Westinghouse Electric & Mfg. Co., Mansfield, O.
Westinghouse X-Ray Co., Inc., 21-16 43rd Ave., Long Island City, N. Y.
Weston Electrical Instrument Corp., 619 Frelinghuysen Ave., Newark, N. J.
Wheatland Tube Co., 606-608 Real Estate Trust Bldg., Philadelphia, Pa.
Wheelco Instruments Co., 1933 S. Halsted St., Chicago, Ill.
Wheeler Mfg. Co., C. H., 19th, Lehigh & Sedgley Aves., Philadelphia, Pa.
Wheeling Corrugating Co., Wheeling Steel Bldg., Wheeling, W. Va.
Wheeling Metal & Mfg. Co., Box 56, Wheeling, W. Va.
Wheeling Steel Corp., Wheeling Steel Corp. Bldg., Wheeling, W. Va.
White Flo-Matic Corp., 30 Elm St., Hoosick Falls, N. Y.
White Mfg. Co., 2362 University Ave., St. Paul, Minn.
Whitehead Metal Products Co. of New York, Inc., 303 W. 10th St., New York, N. Y.
White-Rodgers Electric Co., 1209 Cass Ave., St. Louis, Mo.
Whiting Corp., 15696 Lathrop Ave., Harvey, Ill.
● Whitlock Mfg. Co., 100 South St., Hartford, Conn.
Whitney Chain & Mfg. Co., The, Bartholomew Ave., Hartford, Conn.
Whitney Mfg. Co., W. A., 636 Race St., Rockford, Ill.
Whitney Metal Tool Co., 110 Forbes St., Rockford, Ill.
Whittington Pump & Engineering Co., 225 S. Meridan St., Indianapolis, Ind.
Wickes Boiler Co., 502 N. Water St., Saginaw, Mich.
Wickes Brothers, 500 N. Tilden St., Saginaw, Mich.
Wickwire Spencer Steel Co., 500 Fifth Ave., New York, N. Y.
Wiedemann Machine Co., 1815 Sedgley Ave., Philadelphia, Pa.
● Wiegand Co., Edwin L., 7610 Thomas Blvd., Pittsburgh, Pa.
Wilcolator Co., 17 Nevada St., Newark, N. J.
Wilhelm Co., A., 3rd and Bern Sts., Reading, Pa.
Will-Burt Co., The, Orrville, O.
● Williams & Co., J. H., 225 Lafayette St., New York, N. Y.
Williams Gauge Co., 1620 Pennsylvania Ave., N. S., Pittsburgh, Pa.
Williams, Inc., F. C., 22667 Michigan Ave., Dearborn, Mich.
Williams Oil-O-Matic Heating Corp., 1201 East Bell, Bloomington, Ill.
Williams & Son, I. B., Dover, N. H.
Williams Valve Co., D. T., Spring Grove Ave. & Township St., Cincinnati, O.
Williamson Heater Co., 337 W. Fifth St., Cincinnati, O.
Willis Mfg. Co., Inc., 156 N. Academy St., Galesburg, Ill.
Willson Products, Inc., 348 Thorn St., Reading, Pa.
Will-Weld Mfg. Co., Inc., 1501 Jackson St., Omaha, Nebr.
Wilson & Co., 4100 S. Ashland Ave., Chicago, Ill.
Wilson Co., H. A., The, 105 Chestnut St., Newark, N. J.

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●Wilson, Inc., Grant, 4115 W. Taylor St., Chicago, Ill.
Wilson Welder & Metals Co., Inc., 60 E. 42nd St., New York, N. Y.
●Wing Mfg. Co., L. J., 14th St. & 7th Ave., New York, N. Y.
Wiss & Sons Co., J., 33 Littleton Ave., Newark, N. J.
Wittenmeier Machinery Co., 850-860 N. Spaulding Ave., Chicago, Ill.
Wodack Electric Tool Corp., 4644 W. Huron St., Chicago, Ill.
Wolff & Munier, Inc., 222 E. 41st St., New York, N. Y.
Wolverine Tube Co., 1455 Central Ave., Detroit, Mich.
Wood Conversion Co., 1981 First National Bank Bldg., St. Paul, Minn.
Wood's Sons Co., T. B., 1275 Fifth Ave., Chambersburg, Pa.
●Worthington Pump & Machinery Corp., Harrison, N. J.
Worthington-Gamon Meter Co., Harrison, N. J.
Wright-Austin Co., 315 W. Woodbridge St., Detroit, Mich.
Wyckoff & Son Co., A., 100 Home St., Elmira, N. Y.

X

X Laboratories, Inc., 25 W. 45th St., New York, N. Y.
X L Refrigerating Co., 1834 W. 59th St., Chicago, Ill.
X-Pando Corp., 4315 Thirty-Sixth St., Long Island City, N. Y.

Y

Yardley Screen & Weather Strip Co., 138 Parsons Ave., Columbus, O.
●Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.
Yates-American Machine Co., Beloit, Wis.
Yeomans Bros. Co., 1470 N. Dayton St., Chicago, Ill.
Yoder Co., The, 5500 Walworth Ave., Cleveland, O.
York Corrugating Co., Adams St. & W. M. R. R., York, Pa.
York Ice Machinery Corp., Roosevelt Ave., York, Pa.
York Oil Burner Co., Inc., P. R. R. & Jessup Pl., York, Pa.
Yost Mfg. Co., Meadville, Pa.
Young & Bertke Co., 1004-1014 Hulbert Ave., Cincinnati, O.
●Young Radiator Co., 709 Mead St., Racine, Wis.
Young Regulator Co., 4500 Euclid Ave., Cleveland, O.
●Youngstown Sheet & Tube Co., 602 Stambaugh Bldg., Youngstown, O.

Z

Zapon-Brevolite Div., Atlas Powder Co., North Chicago, Ill.
Zeh & Hahnemann Co., 182-200 Vanderpool St., Newark, N. J.
Zenith Electric Co., 607 S. Dearborn St., Chicago, Ill.
●Zink Co., John, 4401 S. Peoria St., Tulsa, Okla.
Zobell Electric Motor Corp., 96 South Ave., Garwood, N. J.

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